American Machinist

DECEMBER 18, 1935

Many WELDS MAKE the ZEPHYR

Noteworthy for novel methods, Lincoln's entry in the medium priced field has a 280-part body fabricated by 3,740 welds

NEW METHODS make possible new products. Without the developments in welding practice the all-steel body of the new Lincoln-Zephyr might be a dream but not a reality. For welding not only plays an important part in the making of these bodies; they would be impossible without it.

Utilizing practically all the accepted methods of welding, the Briggs Manufacturing Company takes 280 separate pieces of No. 12 to 19 gage sheet steel, weighing approximately 800 lb., and welds them into a solid structure that is virtually one piece. Almost 3,800 welds of various kinds are used to join these pieces together.

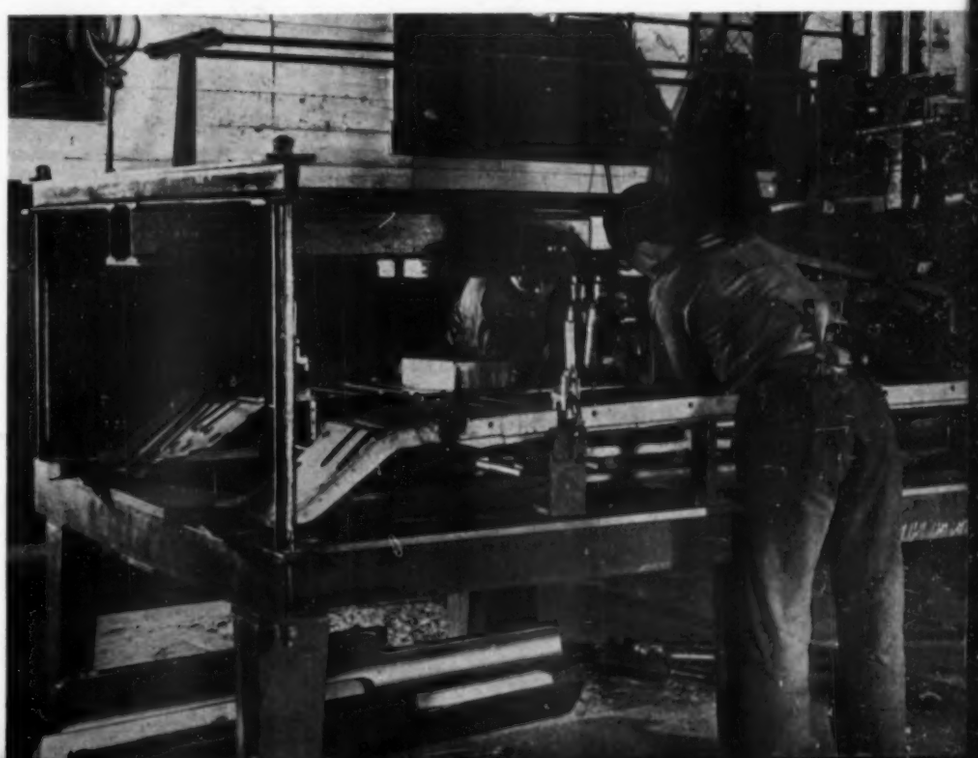
How well the design and the structure stand severe tests can be judged by the loading of a body, supported as it would be in service, with 10,000 lb. of sand. With this extreme load the deflection in the center is less than ½ in., and this deflection disappears as the load is removed. A further, unintentional, test was made when a car was struck amidships by a hit-and-run driver and rolled over three times. None of the three occupants was injured; after being righted, the car was driven home under its own power.

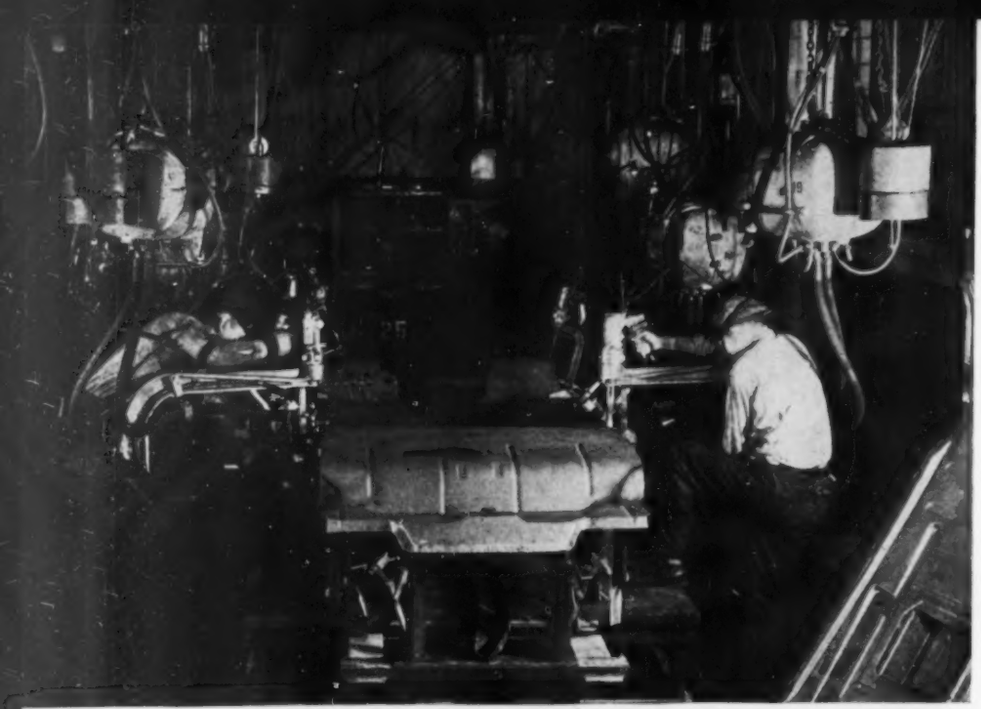
Three main units go to make up the Lincoln-Zephyr body, the foundation, the front end and the balloon or rear portion, which includes the all-steel roof. These three units are welded into subassemblies in separate departments and come together, via conveyors, for final welding into a homogeneous structure. The foundation consists of two light, 3-in. channels, tied together with six cross members of various sizes and shapes. The floor is built of three steel units, right and left side plates being welded to the central drive shaft tunnel as in Fig. 1.

Bringing the completed floor and the channels together in the welding fixture Fig. 2 the foundation is completed, mostly by what is called "gun" welding, this being spot welding by means of portable welders which resemble riveters for similar purposes. These gun welders get current from a transformer having a 220-volt input with 7½ volts on the secondary coils, the rating being 24 kva.

Arc welders are used in tacking parts together and for joining braces and similar parts to the channels. Oxyacetylene torches come into play in much of the thin metal welding, such as filling seams between adjoining pieces, while long seams, such as the joining of the top and the quarters, is done by butt welds in special machines, as will be seen later.

The instrument board, cowl and





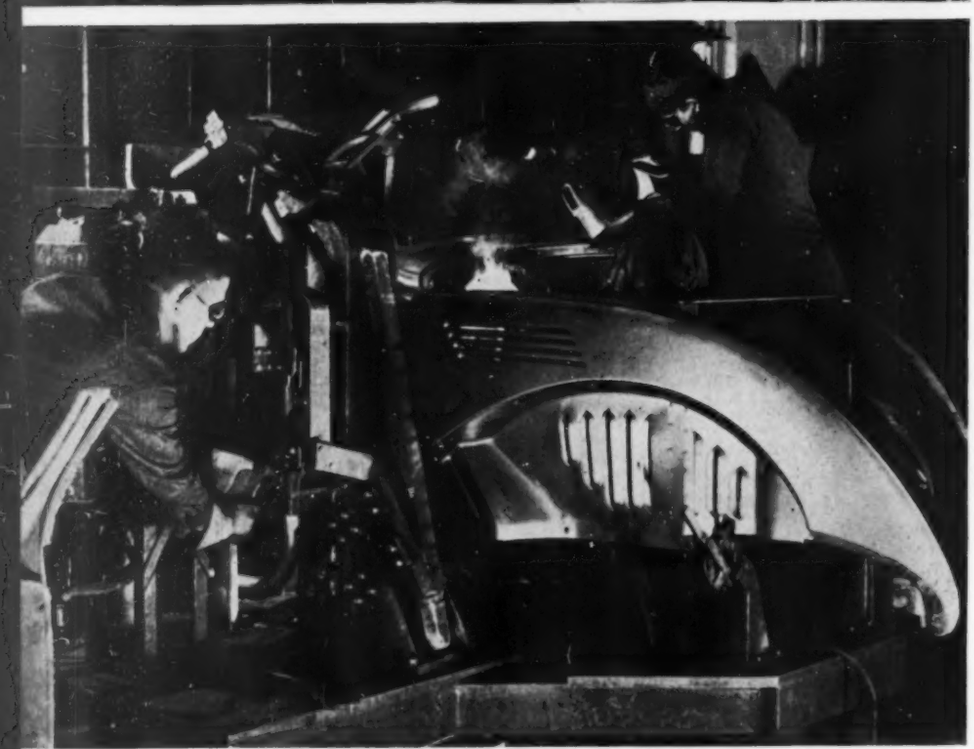


Fig. 2—Floor and channels are fabricated in a jig by means of portable "gun" welders

• *Fig. 3—Another jig is used for the front end to bring the windshield opening, cowl and front wheel housings into one subassembly*

dash form a subassembly of the front end group. Right and left side pieces are held in special jigs while formed braces are welded in place to stiffen the sheets and to form the secondary upper arch of the truss. These are joined to the front sides or stationary hood in the welding jig in Fig. 3. Here again the gun type spot welder does the work in short order.

The front end units are placed on conveyors on which the grinding of welding flash and other similar operations are performed. In the meantime the rear unit, known as the balloon assembly with the top in place, is being assembled and welded. The rear quarter panels are held in jigs with welding reinforcements—window frames and the like—in place. Then the quarters and the large roof stamping are fastened in a suitable frame, and this frame goes into the special welder, Fig. 4, where the three units become one piece.

The upper arched truss which joins the lower channel at both ends goes over the top of the doors and forms a very deep truss. While in this machine both butt welding the sides of the roof and gun welding of other joints are completed. Then the tail pieces are welded on each rear quarter, and the rear cross piece that forms the bottom of the tire well is gun welded in place. This unit is also placed on a platform conveyor on which any trimming of welds is done, and goes on its way to the assembly of the body in the white.

Final welding of the three units into the complete body is done in the large framing jig shown in Fig. 6. The subassemblies come together at this point and the two ends are positioned on the floor or foundation unit in the framing jig itself. A special hoist carries the floor member into the press where it is positioned and the other two units are located properly in place. Here the three parts are welded into a well trussed and braced shell which has remarkable strength and stiffness, as shown by the tests mentioned at the beginning.

The assembled body is lifted out of the welder by the same hoist that handles the floor unit, carried out at the end and lowered onto a suitable dolly, or truck, on which it remains until it is shipped to the Lincoln plant. While on this dolly the body joins the final conveyor line on which the doors are hung, the top of the hood is bolted to the substantial spring hinges which support it at the cowl, and the tire compartment door fastened to the special hinges. This door, incidentally, forms the aerial for the radio and so must be insulated from the car body itself. Heavy rubber cushion strips around the door and on the hinge mountings provide this insulation. Another convenient provision in these days of cars low enough to step into without a running board are large tool-box spaces provided under the rear seat, formed by welded sheet metal supports for the cushion, each side of the shaft tunnel.

On this same conveyor line the radiator grille is fitted and bolted in front, all window spaces are gaged for size, and in the case of the movable windows, for clearance.

The final touches of smoothing up for the priming coat to be put on at the Lincoln plant are made before the body leaves for the shipping dock.

Frames for the front seats have been welded up ready for trimming, the entire frame work being of steel. Special

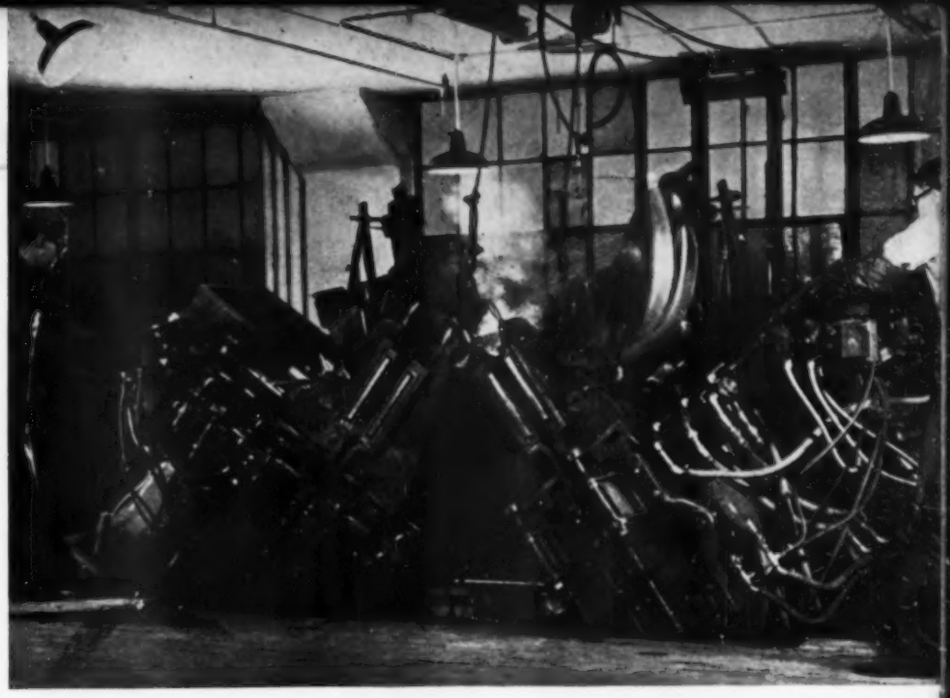
frames for holding the seat frames facilitate the work to be done.

On reaching the Lincoln plant the bodies are suspended on overhead conveyors which leaves the men free to work underneath for attaching the running gear. This reverses the usual practice of building up a chassis from its deep frame and putting the body on as the last operation in the line. The muffler, which is very flat oval in shape, goes across the rear of the car behind the gas tank. Both of these are among the first units to be installed.

A convenient form of transfer truck has been designed for carrying, turning and raising or lowering the bodies while they are being shifted from the receiving bay to the overhead conveyors just mentioned. It has its own motor for both raising and lowering, and the motor can also be used as motive power for moving the body from one line to the other. This truck serves three conveyor lines, the travel being limited only by the length of the flexible cable which supplies the motor with current.

Before the bodies go to the assembly lines they go through special washing booths, drying ovens and to the new hydro-filtered spray booths where they receive the lacquer that distinguishes the finish of the modern car. These spray booths are supposed to be the last word in equipment of this kind, being air conditioned and having a constant flow of water down each side of the booth to catch and carry away any dust particles that might be present in the air which would mar the fine finish.

Fenders, wheels and similar parts are bonderized to prevent rust, and this treatment makes a good base for



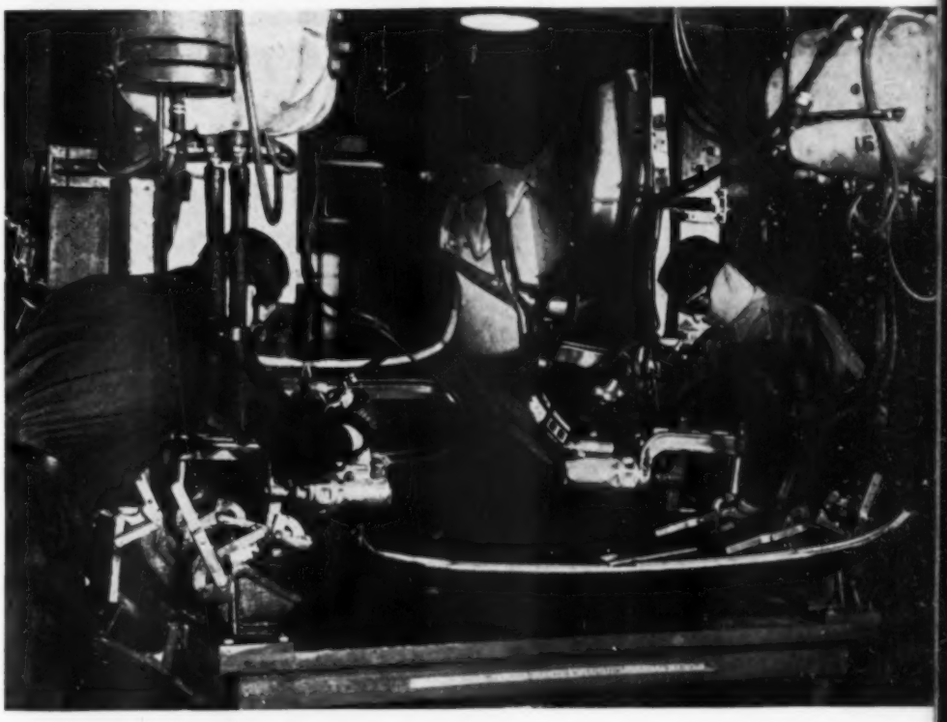
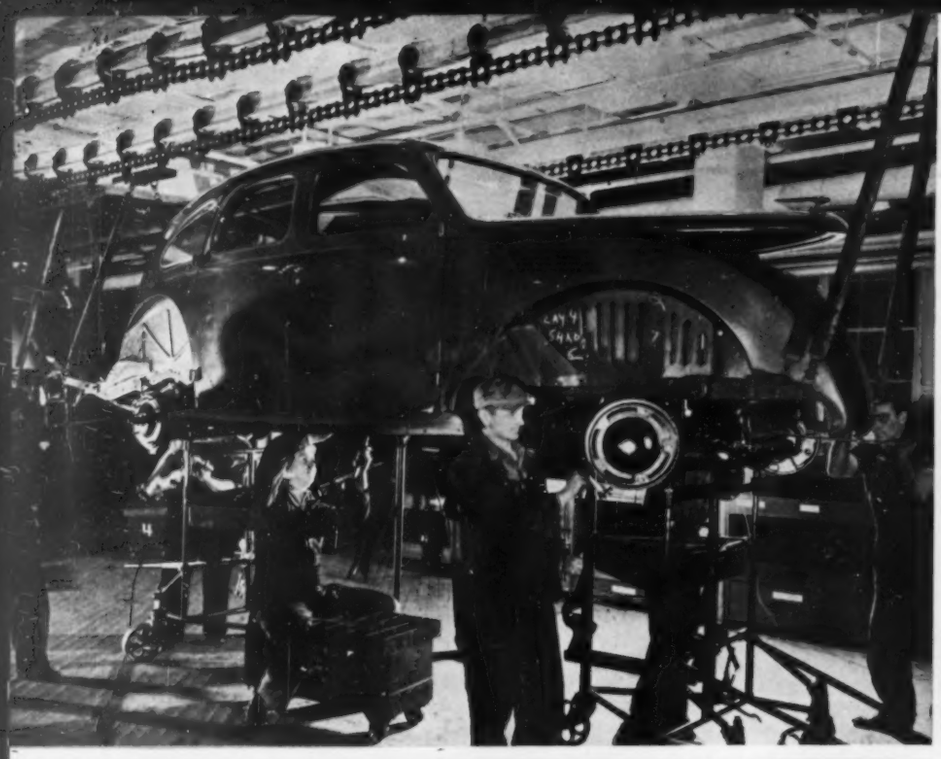


Fig. 4 Above — Quarter panels and the large roof stamping are fused into one in a large special resistance machine

• *Fig. 5 Center — Gun welders figure again in reinforcing the roof*

• *Fig. 6 Left—Final fabrication of the three major subassemblies is done in a large framing jig*



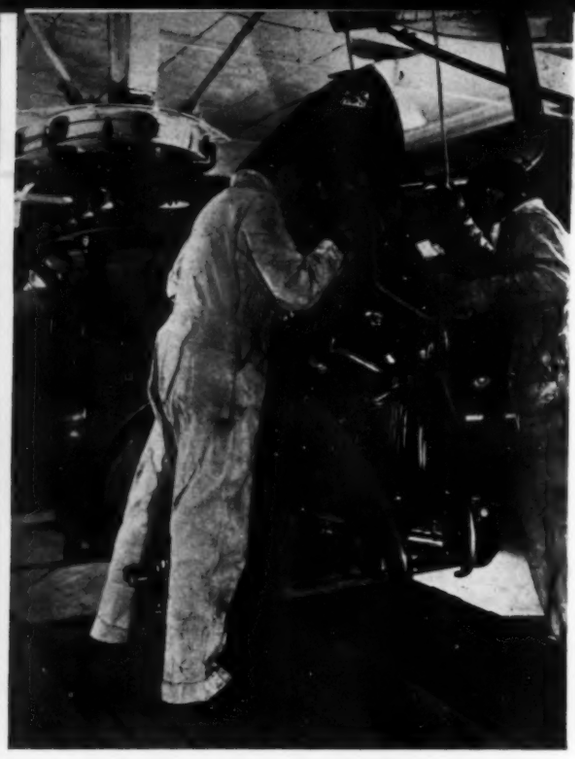


Fig. 7 Upper left—Dollies prove convenient in mounting the body on the axles

• *Fig. 8 Above—Installation of the motor is aided by the use of a C-shaped arm*

• *Fig. 9 Left—The radiator grille is fitted over a wooden form*

protective painting. The overhead conveyor lines handle all these bodies and storage lines can handle a surplus of bodies so as to act as a reservoir to balance the flow to the assembly lines. Some idea of the extent of these conveyor lines may be had from the fact that there are three miles of them for the Lincoln-Zephyr alone.

Both front and rear axle units are complete when they reach the assembly line. Both have radius rod braces and the rear axle housings have a substantial torque tube. These units are mounted on three-wheeled dollies which can be raised and lowered by suitable toggles operated by hand levers. Two of these trucks, one for front and the other for rear axles, are shown in Fig. 7. These dollies carry boxes for all the bolts and nuts that may be needed in the assembly. With axles lifted the springs contact the spring pads under the body and are easily bolted in position. At the same time the shock absorbers are connected, the brake rods connected to the pedals and any other underbody work done at the same time. With cars suspended in this way it is very easy to get at any part under the car that may need attention.

After both axles are in place and the underbody work done the body is lowered from the overhead conveyor to one of the usual floor type as in Fig. 8. This makes it easy to install the motor, as can be seen, this being supported on a C-shaped arm that permits it to clear the lifted hood and lower the motor into place. This shows how easy it is to remove the motor, should it be necessary, by merely taking out the radiator grille, which leaves the whole front clear and open for accessibility.

The grille itself is being finally fitted over the form shown in Fig. 9. It is clamped in position on the form by the large, central bar that extends the whole length of its nose. This view also shows the substantial construction of the upper surface of the grille against which the hood fits when locked in place at the front end.

Wheels, already tired, are then mounted on the wheel drums, and the cars roll on their own rubber. Brakes are finally checked to insure uniformity in action, electrical connections are completed and the car is ready to roll.

LATHE TOOLS for BURNISHING

EDWARD GREENSPON

New ideas applied to the old process of rolling obtain a smoother and denser finish

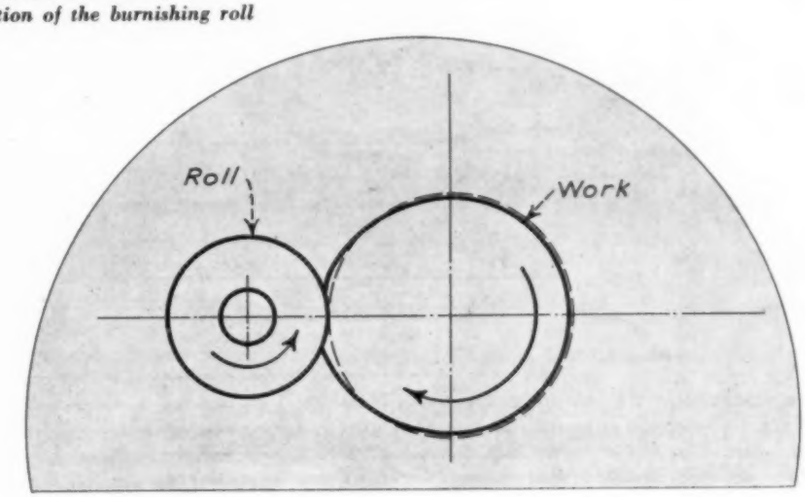
BY ITS very nature (rolling and compressing the surface of metal parts) burnishing is a process requiring considerable pressure. The amount depends on the material, shape and size of the work. Body and hole burnishing put very little added stress on machine bearings when properly designed tools are used, and the power required to revolve the spindle is usually no more than for taking a roughing cut on the same diameter. Face burnishing is quite different. The end thrust developed places the greatest strain on the machine bearings and on the turret-feed mechanism. In fact, it is advisable to put face-burnishing jobs on larger machines than indicated by the bar-stock size.

Since the advent of precision boring machines the burnishing of holes in castings, forgings and similar parts is not practiced so extensively, except for parts too large for these newer machines or where the extra operation is not warranted. Thus, the process is now somewhat limited in application except for work done on the automatic screw machine and the turret lathe. Here, however, there are many applications on the outside diameter, the bore or the face of parts, and these surfaces may be straight, tapered or formed.

Of course, the purpose of burnishing is to wear down high spots left by boring and turning tools, to size holes or diameters accurately, and to work harden and polish working surfaces that must take considerable wear, but which are not to be otherwise hardened or finished. Burnishing is sometimes done on parts that are to be hardened but which are of such shape that grinding is either uneconomical or impossible. The purpose is, of course, to break down the high spots and to get a dense, smooth surface which may be polished after hardening.

At the beginning of the burnishing operation, as shown in Fig. 1, the pressure deforms the metal on both sides of the roll, but more so on the approaching than the receding side. As the high spots and softer surface are kneaded down, the metal work hardens, and as the cross-slide contacts the stop, the roll rides on the compressed and hardened surface, truing and polishing it.

Fig. 1 — High spots are kneaded down by the action of the burnishing roll



Single-contact tools, such as shown in Fig. 1, should be avoided as a general rule. But there are instances where they can be employed, the conditions being favorable. Given a 1-in. automatic working on 1-in. bars, and with a surface ¾ in. in diameter by ½ in. long to burnish, it is possible to secure satisfactory results with the single-contact tool as far as 2 in. from the spindle nose. Beyond this the bar will spring and hammer, and too much strain will be placed on the spindle bearings. This does not apply where an outboard support can be used, but the likelihood of over-stressing the spindle bearings should always be kept in mind.

It is always advisable to carry hole burnishers and face burnishers that will center themselves in a floating holder. A common form of roller-burnishing tool for straight holes is shown in Fig. 2. The tool is so positioned on the turret that the rapid advance carries the rollers into the hole until the cone end of roller cage *A* contacts the bottom of the hole. During the feeding cycle, the spring *B* in sleeve *C* forces the shank *D* forward, thus expanding the rollers *E*. These rollers should be a close fit in the roller cage. Spring *F* serves to keep the cage and rollers at the smaller end of the taper, allowing the rollers to slip into the hole without binding.

Just before the end of the feeding cycle, the stop screw *G* contacts the end of the shank *D*, providing the positive feed to the rollers necessary to size the hole accurately. An included angle of 1½ deg. for the rolls and 3 deg. for the shank will be satisfactory for most work.

For deep holes, where the burnished portion of the work is at the outer end and the stroke of the machine does not permit the use of an extension

stop, the roller cage is designed with a thrust collar, as shown in Fig. 3. This collar butts against the face of the work.

A very cheap and often quite satisfactory form of hole burnisher is illustrated in Fig. 4. It consists merely of a shank, screw and set of balls. The end of the shank is hooded to help retain the balls, and should be hardened and ground. This tool is fed into the hole as in boring. There is no ajustment for wear, but the screw and balls can be replaced at comparatively little expense. The shank will last indefinitely.

Another ball-type burnisher for burnishing a ball race is shown in Fig. 5. The sketch is self-explanatory. Variations of this design are used for different forms of races.

A 7/8-in. shaft had a turned portion 5/8 in. in diameter by 3 in. long. The tolerance was plus 0.0000 minus 0.0005 in. A roughing and two finishing cuts were taken on this job, but it was found impossible to hold this with box tools alone and obtain the required production. The cutter block was removed from the final-finish box tool and replaced by a roller holder. The rollers were cut down to make the contact surface 1/8-in. wide. The remaining finish box tool was set so that any variation would be an oversize. The burnish tool held the work consistently to the required dimensions.

Tools used for end burnishing should always be designed so that no side thrust will be developed to put the machine under excessive strain. Further, when burnishing radii the axis of the rolls should be at right angles to the bisecting line of the arc if possible. Radius tools in which this rule has been disregarded usually turn out to be failures.

Fig. 6 shows a tool that was designed to burnish a 2-in. spherical radius on a rear-axle differential gear. This tool failed to produce satisfactory work because: first, the two rollers tended to force the feeding spindle off center, resulting in the production of inaccurate radii; and second, the rollers tended to remain stationary, not being mounted at right angles to the radius. If a chip happened to wedge itself in between the stationary roll and the revolving work, the surface was torn and the piece spoiled.

A new tool, Fig. 7, was designed for this job. As shown, it is a three-roll type, and being held in a floating holder, it centered itself perfectly. The

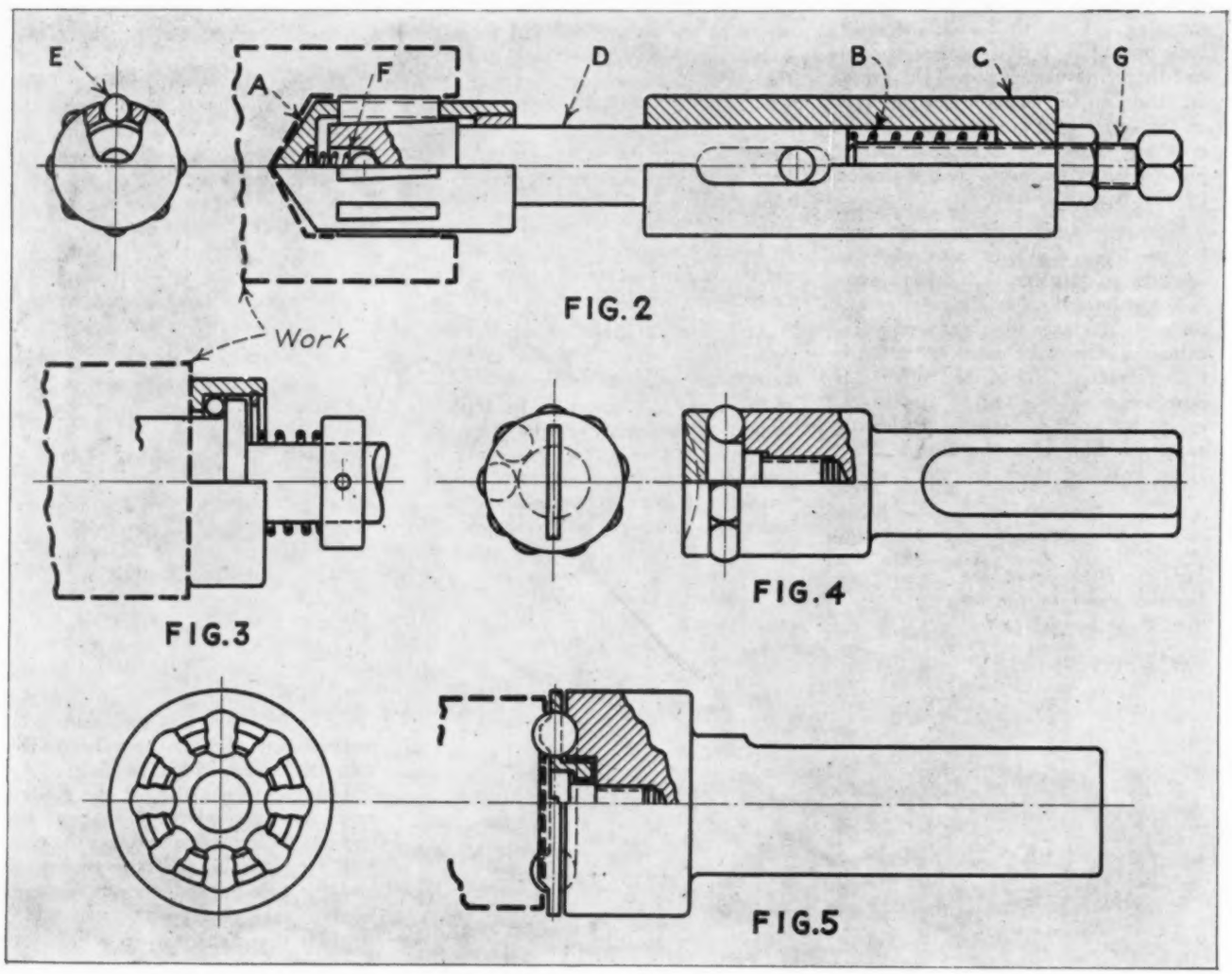


Fig. 2—Tapered rollers E are expanded in the hole by wedge action of shank D during the feeding cycle of the current. Fig. 3—Where an extension stop cannot be used in deep holes, the roller cage may have a thrust collar. Fig. 4—Very often this cheap, but effective, tool will do the job. Fig. 5—When ball races are to be smoothed this face-type burnisher may be employed

axis of each roll is at right angles to the work radius and placed so little or no resistance is offered to rotation of the rolls, even under the heaviest pressures. At the same time enough friction is developed to obtain the desired polishing action. It should be noted that the radius is formed in the roll on its center line, making a concave surface with both shoulders the same height. This results in an entire absence of end thrust in these rolls. End thrust contributed greatly to the failure of the tool shown in Fig. 6. These rolls, Fig. 7, are mounted on needle-roller bearings. This tool produced completely satisfactory work with the first piece, and when the writer last heard of it, it had been in operation for 2½ months on a 24-hr. shift and was apparently no worse for wear.

Just as important as proper design is the selection of the steel used and its hardening. High-speed and carbon tool steels do not stand up satisfactorily in this service. If SAE 52100 is not available, a high-grade die steel should have the preference. Rolls should be quite hard, Rockwell 62-65C, and the surface highly polished.

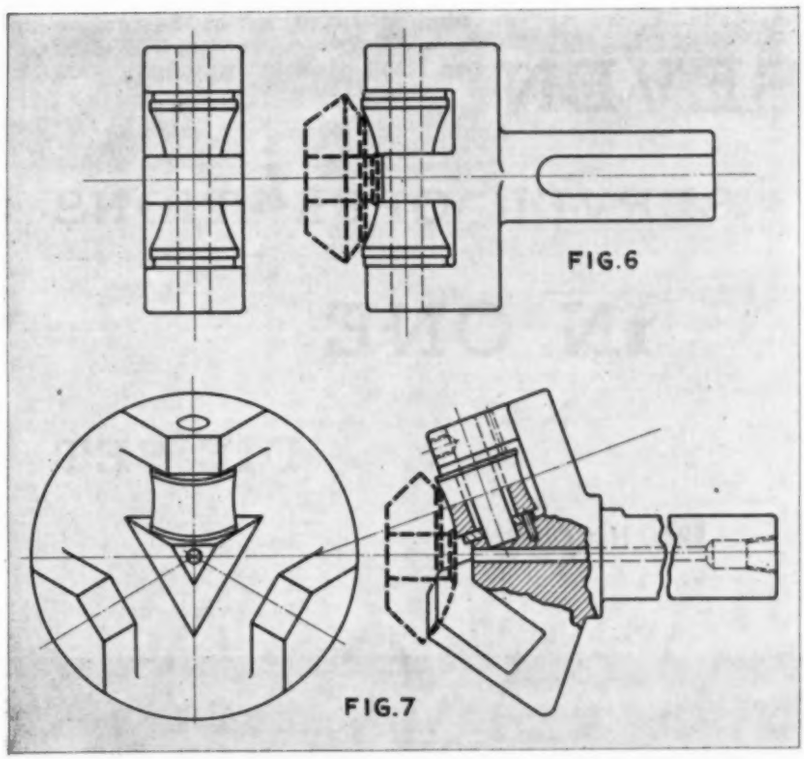


Fig. 6—Two faults were found in this tool for burnishing a spherical surface: first, the rollers forced the feeding spindle off center; second, the rollers dragged and a chip would ruin the burnished surface. Fig. 7—The shortcomings of the tool in Fig. 6 were overcome by three rollers placed tangent to the surface of the work

Preheating Bearings for Lining With Babbitt

JOHN E. HYLER

The advantage of moderately preheating bearings before lining them with babbitt, particularly in cold weather, cannot be denied. There can be no question that when a bearing is too cold at the time of pouring the lining, the babbitt will be chilled to the point where it will not completely fill the bearing, resulting in a poor job. Then, too, those who are strong for preheated bearings contend that preheating will drive off any entrapped moisture, making for safety in pouring as well as for a better job.

It is claimed by many that if the bearing is heated to an excessively high temperature, the grain of the babbitt will be coarsened, resulting in a job that is not so good as it should be. If and when the bearings in a forked rod are to be lined, excessive temperature in preheating is practically certain to get one in trouble. As the temperature is increased, considerable of the heat is inducted into the ends of the connecting fork, while the centers will remain comparatively cool and in an unexpanded condition. It cannot be expected that the entire assembly will expand, receive the babbitt, contract in cooling and still remain in correct alignment.

At the moment the babbitt is poured, the assembly will be in an expanded condition. The bearings will be farther apart than normal and will be thrown out of alignment to some degree. If the pouring is done on a mandrel, the linings will be in alignment. However, as the assembly cools and contraction takes place, the bearings will come back to their original alignment, but the linings will then be out of alignment, possibly requiring hours of tedious scraping to get them back into correct alignment.

The natural conclusion is that great care should be used in preheating the bearings of forked rods. If dampness in the bearings is suspected, they should be heated relatively hot to drive it out, but an interval of time should be allowed for contraction to take place before the babbitt is poured. A pretty safe guide is to allow the bearings to cool to the point where they feel just comfortably warm to the palm of the hand, at which time the linings can be poured to the best advantage.

Manchester Makes Flying Flea

While the United States government has been trying to stimulate interest in manufacturers in the building of a light-weight, low-cost airplane, the firm of F. Hills & Sons, Ltd., Manchester, England, has designed and built such a plane and is engaged in getting into production on others. The cost of the Flying Flea, now in production, inclusive of engine, is £170 and has a normal cruising speed of 70 m.p.h. The length is 13 ft. and the wing span 19 ft.

Wings are arranged to be pivoted around parallel to the body reducing the width to 5 ft. so the airplane can be housed in a garage. It is light enough for one person to wheel around. The controls of the machine, which is a single seater, are said to be simpler than those of a motor car and are claimed to be fool-proof.

Another larger plane, to accommodate two passengers, is being introduced by the same concern. It is dual controlled, has a maximum speed of 94 m.p.h., and a fuel consumption of 33 m.p.g. The cost will be about £380.

SEVEN SERVEL OPERATIONS IN ONE DIE SET

FRED H. COLVIN
Editor

MODERN press working of metals is distinctive for its ingenuity and accuracy. The aims of the engineer are often more closely fulfilled by the use of stamped articles than by some more simple process. Intricate shapes can be produced at high rates of production, and the resulting cost may be lower, or at least acceptable in view of the better performance of the product.

In the evolution of heat exchangers the plain tube gave way to the finned tube; now comes a tube comprised of cups so made that even greater efficiency is obtained. This latest design has been evolved for the Electrolux refrigerator made by Servel, Inc. At that plant the cups are known as gas-heat-exchanger disks. Fig. 1 shows the seven stages of making this rather intricate piece, and the method of assembly into a tube. The flanged end of one disk is a snug fit in the necked-down portion of the succeeding disk.

The gas heat exchanger disk is made in progressive dies. Fig. 2 shows the press with the tools in place. The stock is fed in at right angles by the rolls at the left to the first set of tools, where the disk is blanked and then given the

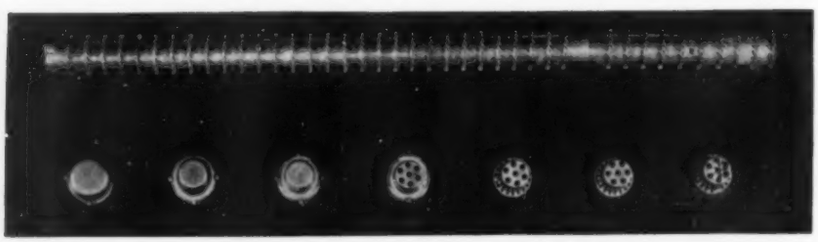


Fig. 1—Electrolux heat exchanger tubes are made up of separate cups, drawn, pierced, crimped and nested together

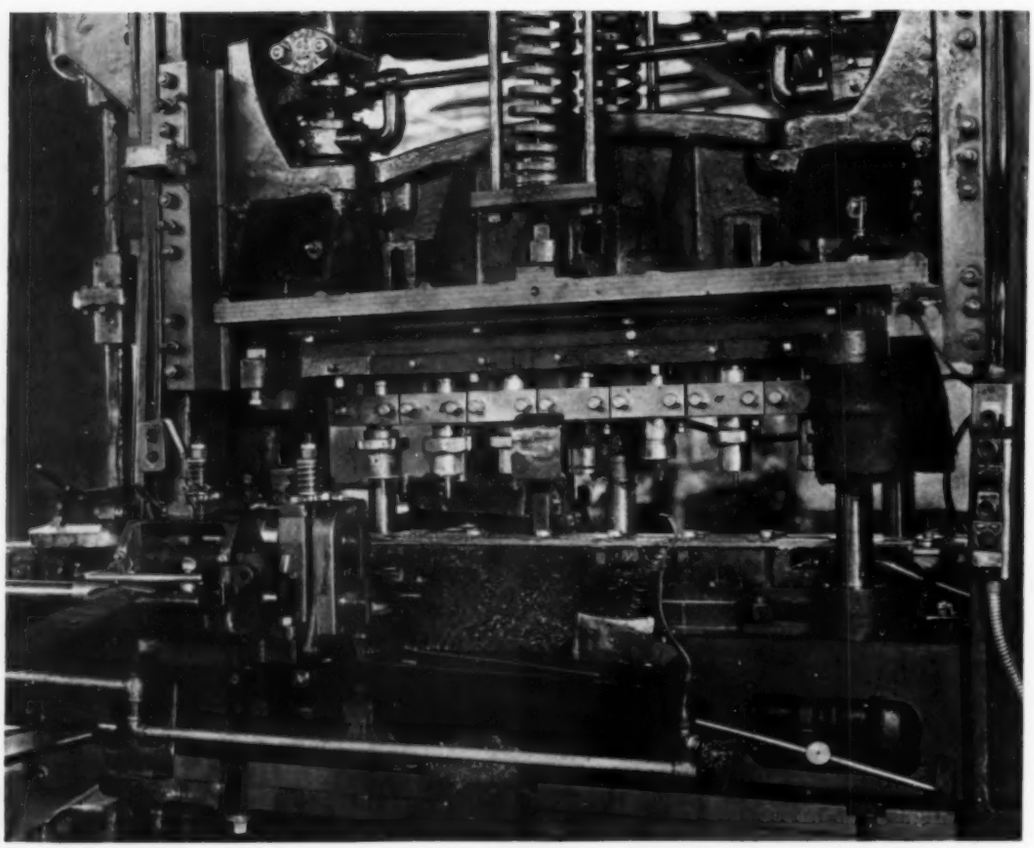


Fig. 2—Strip stock is supplied to the progressive die by the feed rolls at the left

Another tooling set-up adds to the ingenious methods on the Electrolux refrigerator recently described

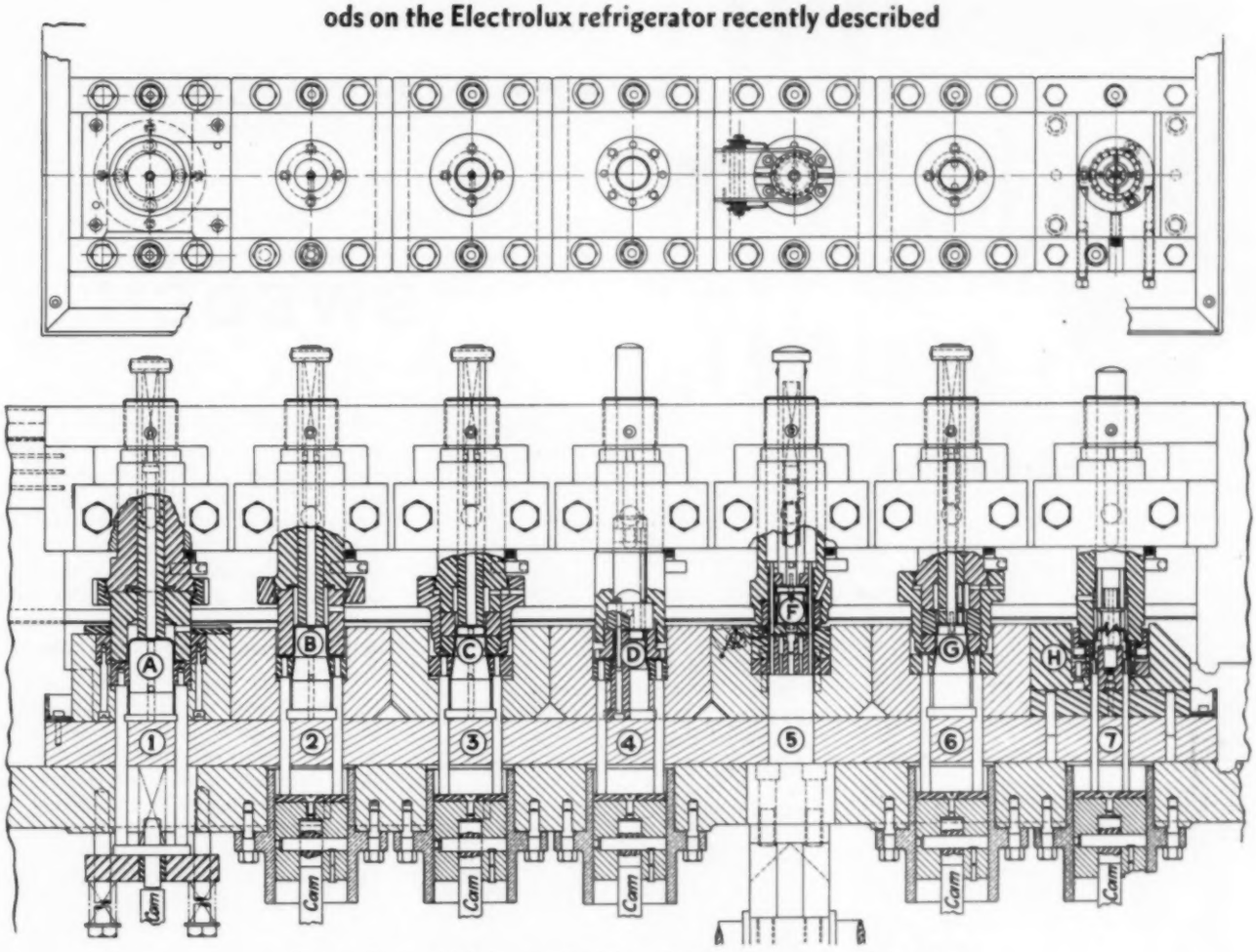


Fig. 3—From initial draw at the left to flange forming at the right, seven parts are stamped simultaneously and one is completed with each stroke

first draw, as at *A*, Fig. 3. The cupped blank is then returned to the level of the press bed by pressure pads beneath and moved to the next set of tools. Here the cup diameter is reduced and the depth increased, as at *B*. The third operation involves necking down the top of the cup so that it will stack with succeeding cups as shown in Fig. 1.

Seven holes are punched in the top of the cup at the fourth operation *D*, while at *F* small holes are punched in the flange and the outer edge is trimmed off to the correct diameter. The blank is positioned during this fifth operation by the cone-pointed guide pin above the center hole. The sixth step sizes the cup and irons out any wrinkles. The final operation consists of slitting and twisting the flange into small fan-like blades and indenting the surface adjacent to the holes on top of the cup.

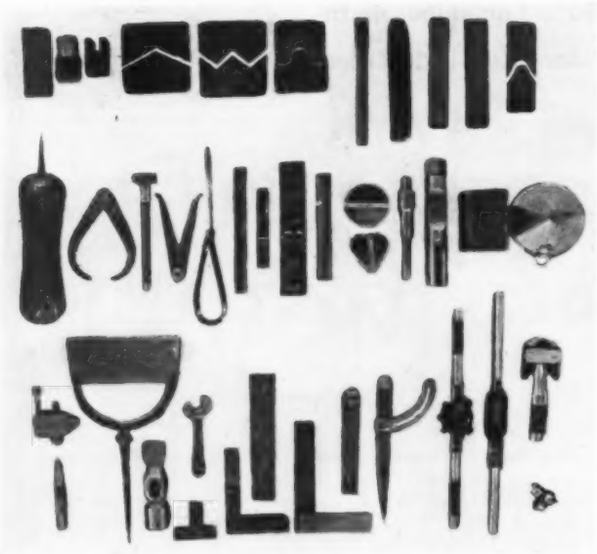
The slitting and twisting operations are done at *H*, Fig. 3, both the inner and outer tools being shown in heavy outline. These tools finish the disks and leave all the openings in such shape as to encourage the flow of gas through them and to obtain turbulence. A study of the seven sets of tools will enable anyone interested in press work to follow the operations.

Lubrication of Railroad Axles

C. G. WILLIAMS

In former discussions of the subject of grinding axles, mainpins, and crankpins, some writers pointed out that the rolled bearing surface gave longer life and less trouble from hot boxes. This viewpoint of the subject has been held for years by the few men who would experiment or who would take the trouble to make a record of the reported hot boxes and note the wear of axles as driving boxes were removed for crown brasses or for reboring.

It is not generally known, nor was it known or even thought possible up to a few years ago, when the test department of the Rock Island railroad began to make definite tests, that at times friction in the main bearings of our largest locomotives, developed a heat of approximately 1200 F. and that for sustained periods. The test department also discovered that by the use of a comparatively light oil, about equivalent to common car oil, delivered to the bearings under pressure, in place of the heavy hard grease customary on these bearings, would reduce the heat to 140 F. at the highest, and maintain it at this figure, over the same periods, over the same track, and under the same conditions.



Small tools made by the apprentices at the Industrial School at Domnarvet

APPRENTICES in SWEDEN

A. E. FRISTEDT
Stockholm

ALTHOUGH the training of apprentices in Sweden in the more general sense has been going on for decades, the systematic teaching of boys who want to enter the engineering trade is of relatively recent origin. The mechanical trades in Sweden have been greatly influenced by English and German developments in engineering, and for the past 30 or 40 years by impulses coming from the United States. Despite the example set by Germany in the training of boys and young men to be machinists and toolmakers, many of the Swedish engineering firms have no apprentice courses even today. They draw their skilled help from other companies, or from the general labor market.

An ambitious youngster anxious to learn a trade may go at it in one of several ways. Given a job in a shop or factory he may be left to himself to attain such skill as he may by observing how older mechanics do their work. This method takes too long, of course, and is hopelessly inefficient. A second way is through self-education which is possible in Sweden today, but likely to be incomplete. The experience of those who have been at a given business for years is best handed on to others step by step through organized channels.

It is generally admitted that the boy trained in a trade school is better equipped than the one who has learned individually at his work place. Likewise, the best way of developing craftsmen is to combine the two forms of obtaining skill. Hence the advanced methods of the up-to-date shops are combined with the high efficiency of the school to form a rounded out program of training for the engineer apprentice. As yet no standard courses have been universally adopted, although it is generally agreed that there should be such courses through which a young man could go in order to obtain the minimum of knowledge demanded of a skilled craftsman.

Some 60,000 men are employed in the Swedish engineering industry. Of these, more than 1,000 leave the mechanical trades each year because of old age, natural death, and other causes. Consequently, it is necessary to train at least 1,800 boys annually in order to provide enough skilled mechanics to meet the demand for them. The reason for suggesting the additional 800 is that some apprentices discover after a little training that they are unfit for mechanical work. There must also be some provision for the natural expansion of business as times improve. Unfortunately the total number of boys trained each years falls somewhat short of the required 1,800 mentioned above.

The diversity of products made in the Swedish engineering industries demands the training of different kinds of craftsmen. Such products as ball and roller bearings, telephone and telegraph apparatus and all kinds of electrical machinery, including refrigerators and vacuum cleaners, may be listed among the mass production units. On the other hand, such things as electric locomotives, diesel engines, automobiles, motorships, machine tools and small tools may be manufactured in lots from one piece to a few hundred.

During the depression the training of apprentices was badly neglected. When thousands of skilled mechanics were unable to get jobs, there seemed to be no need of spending money for training more help which could not be absorbed in the industry. But this is not the only reason for this neglect. Many Swedish boys want white collar jobs and some of them make so much money at work requiring little training, that they do not care to learn a trade. Those who go through an apprentice training course usually become good mechanics.

Book and Shop

In the existing courses boys interested in the mechanical work are usually educated both theoretically and practically. The training is at places arranged through the cooperation of the state, municipality and individual employers, and is given both in day and in evening courses. The financial support is provided jointly by these three groups. Apprentice training in Sweden does not stop with an education along mechanical lines. It is also considered important that the boys learn to act as good citizens and that they get adequate physical training.

In an endeavor to stimulate the training of the young people of Sweden, the parliament in 1918 passed a law recommending that trade schools be organized in all large communities and wherever else it was possible. The law also provided a measure of financial support for

Training boys for the engineering trade in Sweden follows much the same lines as in the United States. Nothing in either country corresponds to the elaborate apprenticeship program of Germany

such schools from the state treasury. In the state educational department there is also a division taking care of the trade schools for the whole country. The partial support from the state, however, has not been used to the extent originally intended. Lack of cooperation is claimed to be the reason.

The Swedish Association of Engineers has also done much to promote the interest of its members in training boys for the engineering trade. A committee consisting of several leading Swedish engineers has worked out a booklet which contains many suggestions in connection with the training of apprentices. This committee does not believe that there is less need of craftsmen because of the specialized methods now used in many metal working plants. On the contrary, experience proves that as the accuracy of all mechanical work has been greatly increased over the last few years, the training of skilled workmen is a necessity of growing importance. To hold, or if possible, improve the position among nations manufacturing tools and machinery, the development of first class machinists in Sweden must be carried on at an even higher rate than exists now. It is considered an act of self defense for Swedish industry to look forward to the future and through energetic action work for the improvement and renewal of the working force. Every executive is urged to consider it a duty to persuade boys to become mechanics.

Assistance is rendered in planning different courses in shops and schools to suit general and special requirements. This work corresponds to that of the DINTA in Germany (*AM*—Vol. 79, page 577) and of the Federal Committee for apprentice training in the United States (*AM*—Vol. 79, page 749). Also, the exchange of experiences through visiting other plants is encouraged. Lectures and articles in the technical papers supplement the personal efforts of the engineers to promote apprentice training.

Bench vises, hacksaw and breast drill made at the same school by advance apprentices

In the booklet just mentioned the following points are suggested as a guide in organizing apprentice training courses:

1. The aim of apprentice training is to give the boys knowledge and ability to do a tradesman's job in the trade in which they may engage.

2. The time suggested is four years. A shorter course may be agreed upon if applicants have had previous experience. Under certain circumstances a longer time may be necessary.

3. If no agreement to the contrary is signed before the apprentices start the course, six months of the time is considered as a preliminary period during which, after two weeks' notice, the employer may discharge a boy if he is found unsuitable, or the apprentice may quit if he does not care to follow up the course.

As a rule boys are admitted to trade schools or shop courses after finishing grammar school at the age of about fourteen, but young men of nineteen or even twenty have become good mechanics, after four years of training.

Scientific tests are sometimes used in selecting boys for the mechanical trade. There are many such tests, but few of them have been universally accepted. I am inclined to agree with those who do not pay too much attention to these tests, partly because such important factors in a boy's life as his temperament and inclination for a trade are usually omitted, and also because a temporary indisposition may give an unreliable result.

Beginners are usually paid a few cents per hour for the time spent on practical work and this rate is raised as the boys gain proficiency in their work. At places where complete courses are conducted covering both theoretical and practical exercises, it is common for the boy himself to pay a small fee for the theoretical side of the course, and receive remuneration for the practical work he finishes. Piecework is sometimes practiced.

A good example of the work done in a Swedish trade school is to be seen at the Industrial School at Domnarvet. Here the course lasts three years. The school is organized to give the boys primarily a practical knowledge of materials, tools and processes, but also to give some technical training in mechanical production and also some on problems of a civil character.

During the first year, which is con-

Trade school teachers, foremen and engineers in front of the industrial school at Domnarvet

sidered a preliminary period, a foundation is laid for both the theoretical and practical work that is to follow. Perhaps half the time, or 23 hrs. a week, is spent on shop work. The boys work half the year in the mechanical department and the other half in the pattern shop where they become acquainted with materials, tools and processes as outlined in the foregoing paragraph. Sixteen hrs. per week are spent on such theoretical subjects as the character of the material used, how to take care of tools, elementary mechanics and elements of machines, as well as on drafting mathematics and the Swedish language.

In the second and third years opportunity to study advanced practical and theoretical subjects is given those who have completed the first year course in such fashion as to prove themselves capable of profiting by such tuitions. In the shop which now takes 27 hrs. per week the boys begin to make machine parts which are to be used on machines for which they were made. By this time the boys are given some freedom in choosing the requisite machine tools for a given job. A small group of the third year class is given a special course in oxyacetylene and electric welding.

The theoretical work, 16 hrs. per week, continues the study of technology, tools used, materials, their composition, manufacture and technical constituents, machine tools and machinery for motive power. Instruction is also given in elementary physics and chemistry. Exercises in the Swedish language consist of reading of the literature of the nation and the writing of articles. The course also covers economics and bookkeeping, trade hygiene, laws relating to working conditions, accidents, and employment, and the rights and duties of citizens.

This course starts about August 26 and ends around the first of June. Work begins at nine o'clock in the morning and ends at 5:30 in the afternoon, with 80 min. allowed for lunch. No work is done Saturday afternoon.

It will be evident from the foregoing that apprentice training in Sweden is much more like the unorganized and inadequate training conducted in the United States than it is like the thorough and elaborate training given in Germany. This is the more surprising because of the propinquity of Germany and the remoteness of the United States. Both Sweden and the United States have a training and organization job ahead of them.

The Trade School Crop vs. the College Crop

C. J. FREUND
Dean, College of Engineering, University of Detroit

A few days ago a good friend of mine burst excitedly into the office and pointed out H. W. Teichroew's article, "The Trade School Crop vs. the College Crop," (*AM*—Vol. 79, page 796). My friend's attitude seemed to imply that a strenuous controversy was under way regarding the relative merits of college graduates and trade school graduates.

I read the article and read it again and have not yet discovered any real basis for an argument unless it be the "vs." in the title.

Mr. Teichroew merely described what he considers to be the qualifications of the trade school graduate. After many years' experience in hiring and working with vocational school boys, I quite agree with what he says. He wrote his article within the frame work of mine (*AM*—Vol. 79, page 520). Well, he is certainly welcome to that.

Mr. Teichroew has implied that in certain points the trade school graduate has the advantage of the recent college graduate. He might as well have said it directly because these advantages cannot be questioned by anyone familiar with the situation.

He has not attempted to deny that in many other points the college graduate has the advantage over the trade school boy, for he probably knows it as well as anyone else who is either an employer or an educator. Nothing remains except to point out the obvious fact that the college graduate and the trade school graduate each has his place, that the places are much different; and to say that I enjoyed very much reading Mr. Teichroew's article.

Changing Habits

It's a lot easier to install new machinery and methods than to train the personnal into new ways of thinking. It's a tough job for management to take a plant that has been accustomed to loose fits and change it over to precision work. It is equally hard to eradicate slovenly habits in both personal and shop appearance. It takes tact and perseverance, but several shining examples could be cited to prove it can be done.

COSTING . . .

AN ENGINEER'S JOB

ROBERT S. DENHAM
Chief Engineer, The Denham Cost-finding Company

Two and two are never three, as the ten points given below will show

PRACTICALLY all the efforts made in recent years by trade associations and governmental agencies, proclaimed as corrective of unprofitable competitive conditions in industry, have failed in their objectives.

Deplorable conditions, price-cutting, and other abuses, largely attributable to vagaries in methods of costing and pricing, to misinformation, and to malicious competitors, continue to abound.

Those who have sponsored movements ostensibly aimed at the amelioration of such conditions and abuses, might have been far more successful had they been animated less by their desire for personal prestige or political popularity, and more by an earnest seeking after the truth about costs and profits.

Progress in industrial economics will never be made while leaders of industry continue to act upon the assumption that costs can be created by fiat, that they can be influenced by personal opinions or wishes; or that accurate costing methods can be developed through discussions and compromises, and made permanently practical by a majority vote of persons wholly devoid of knowledge of the principles involved in accurate costing and pricing.

Any movement designed to bring order out of the present economic chaos must, first of all, expose the pernicious formulas involving "overhead" and "overhead distribution," and discredit that amazing hodge-podge of pricing theories that now befog the minds of a vast majority of industrial executives and their associates.

Cost is the sum of the expenses involved — nothing added, nothing omitted. That is fundamental. It is also fundamental that every price for which products are sold should include a fair rate of profit. Inaccurate costing is responsible for erratic and unprofitable pricing.

In any given factory, there is a definite total of expenditures involved in all activities during a designated period. These expenditures have, originally, definite objectives and procure definite benefits. Instead of recognizing the direct relation between expense and benefit, industrial executives have, through misguided organization propaganda, been led to believe that it was their privilege to decide, individually or collectively, whether or not certain expenses should be included in cost calculations, or omitted therefrom; and also to dictate the particular method by means of which the expenses should be applied.

Cost is never affected by arbitrary rulings. Cost is never reduced by the omission of expenses. Costing is governed by fundamental principles, and the effect of arbitrary rulings is invariably to destroy the value and the accuracy of costing calculations.

Every expenditure is a definite amount of money, expended for a definite measure of a definite service or a definite commodity, for which there is a definite use or need. In all of industry there is no expenditure for "overhead." The "overhead" of any costing plan invariably consists of expenses which the sponsor of the plan does not know how to apportion correctly. All bases of "overhead distribution" are arbitrary and misleading.

Every arbitrary ruling, whether it directs omission of an expense item, upon the assumption that cost will be thereby reduced; or misapplication of expenses included in the cost calculation, causes an undercharge to some products and an overcharge to others. The assumption that these undercharges and overcharges will "average correctly in the long run" is a mistake.

Having a choice of the products which they will buy, it is but natural that customers will usually select the best bargains, buying the undercharged items, letting the foolish manufacturer take the losses, and going elsewhere for those overcharged.

A five per cent undercharge will generally destroy the profitableness of a product, while a five per cent overcharge will drive profitable business away.

The executive who uses an inaccurate or arbitrary costing plan automatically becomes his own worst competitor and business enemy. Not only does he drive profitable business to his competitors through overcharging, but he demoralizes his own business and his industry by unwittingly cutting prices on part of his products. Worst

of all, his erratic pricing establishes precedents which cause his customers to demand lower and ever lower prices, until it is difficult for him to secure profitable prices for any product.

The haphazard results of the present personally dictated costing and pricing practices are the prime cause of the customers shopping about, seeking low bids before placing orders. They destroy confidence in industrial ethics, causing demoralization of whole industries, and make it appear that profits are much greater than is actually the case. They are the most prolific cause of business failures.

There is no excuse in this era for the operation of an inaccurate cost system. The cost of operating a dependable system is usually less than that of operating the misleading "direct-labor, overhead, and materials" type of so-called cost system.

Accurate costing is essential to sound business.

There was a time in the handicraft era of industry, when prices were made by a very simple method—by calculating the outlay for materials, computing or estimating the wages involved, and adding to the total any amount that the boss-workman thought the customers would pay. Since there were then no factories but only small shops, serving their own neighborhoods, there was little if any competition, and the customer who wanted the goods paid the price demanded.

Analysis Needed Today

Today, conditions are different. With machines installed for making 95 per cent of products, wages can no longer be considered a basic factor in costing. Costs must be determined by analysis of products and the processes of production, and the charging of particularized (not generalized) expenses to product, through process-unit rates. in the exact ratios of their utilization.

The time has come when industry must have a rational method of costing that can be used universally in every type of shop or factory, from the one-man shop making a single article to the great factory making an infinite variety of products. Such a costing method must be so simple that it can be readily understood by anyone familiar with the technique of modern manufacturing. It should be installed by trained cost engineers, whose qualifications are comparable to those of persons engaged in other engineering functions, including the engineering type of mentality, practical education and, most important of all, an intimate familiarity with the functions and requirements of a great number of manufacturing processes.

No costing plan can be permanently practical and capable of being universally used unless it is based upon sound fundamentals.

No plan of making prices can be practical for general use unless it provides for equitable inclusion of every expense involved in manufacture, and a reasonable rate of profit.

Before such scientific methods can be generally adopted throughout industry the following facts must be recognized:

1. That the prime essential for correcting unfair competitive conditions, for establishing cordial relations between competitors and for eliminating price-cutting and the other abuses of industry is a universal method of costing and pricing that will enable all executives to speak a common language of costing, to establish sound practices of pricing, and to develop costs that are comparable factor by factor, and process by process.

2. That all manufactured products are the result of applying to measured amounts of definite materials measurable amounts of the time of definite forming, assembling or chemical processes.

3. That cost is always the sum of the expenses involved; therefore, the expenses are the elements of cost, and nothing less than the total of all of the expenses involved is cost.

4. That each expenditure is a definite amount of money, expended for a definite measure of a definite commodity or service for which there is a definite need and a measurable use.

5. That only when the identities of the individual expense items are known, their amounts, their objectives, the measures of their uses and their benefits are known, is it possible to trace them accurately into the products wherein they are involved.

6. That the generalization of expenses, resulting in masses of unrelated items, such as are commonly called "overhead" or "burden," destroys the identities of the items and obscures the characteristics by means of which it is possible to properly allocate them, or to measure their benefits.

7. That, since product is composed of definite materials and the time of definite processes, the cost of production can be determined only by considering the outlay for materials (including with the purchase price all of the expenses of handling), the cost per hour, and the number of hours of each process involved.

8. That profit is the amount by which the selling price received exceeds the cost of the goods sold.

9. That profit is always net; is always to be considered in relation to the selling price—never to the cost of the goods sold; and that "gross profit" is a myth.

10. That there are not two factories alike and, therefore, each costing plan must be designed with consideration of the characteristics peculiar to the individual factory in which it is to be used. All plans or systems should be designed according to the fundamental principles of cost engineering, and sound standards of practice. In other words, while uniformity of systems or plans is impractical, universally applicable principles are essential.

The clearest analogy which the writer is able to present as illustrating the relationship between costing systems and the principles of cost engineering is that of modern machines and the principles of applied mechanics.

Although machines are designed and constructed for many purposes and in many forms, each and every machine depends for its successful operation upon its designer's application of the principles of applied mechanics. Likewise, any costing plan must fail unless, in its design, it conforms to the principles of cost engineering.

As with machines, like forms are not essential. Efforts to create uniform machines for widely variant purposes would be no more impractical than has been the effort of recent years to create "uniform cost systems" for use in widely variant factories.

In either case the violation of a single fundamental will weaken the efficiency of machine or system, and the common practice of building plans of costing without consideration of fundamental principles can have only disastrous effects upon industry.

PRICE and PRECISION

MADE US BUY

Reequipment checked rising costs and gave a better product

Pulley brackets are drilled, reamed, counter-bored and spot-faced on a heavy duty vertical drill

R. H. MEISTER

President and General Manager
Cedar Rapids Engineering Company

A new surface grinder finishes grinding wheel flanges

WITH production costs pyramiding with alarming rapidity and a class of customers who couldn't stand price increases the Cedar Rapids Engineering Co. found itself recently in a serious position regarding its future business policy. Our problem was that of keeping selling prices down to the normal level and at the same time building more quality, greater accuracy and increased money-making possibilities into motor reconditioning equipment which we make and sell.

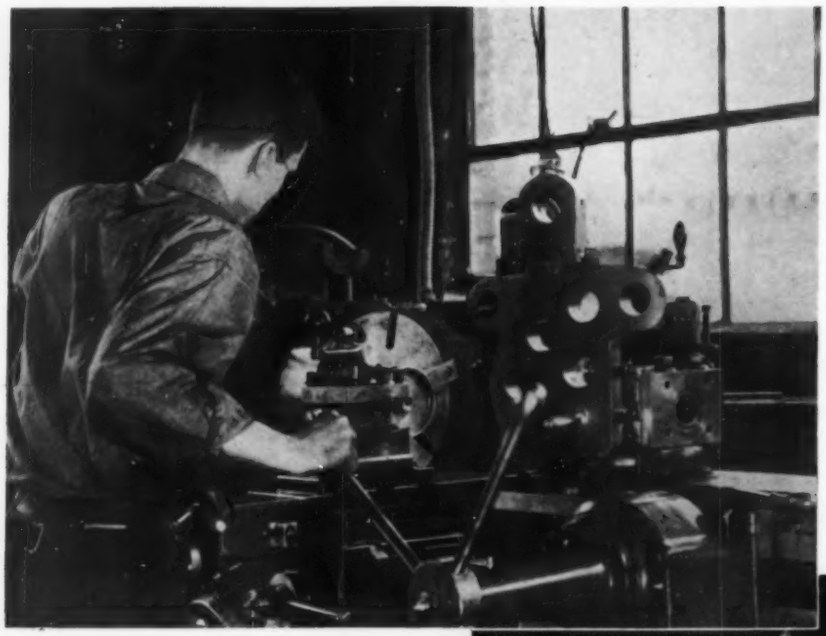
Needless to say, the solution of the problem brought us a good many anxious hours and was only solved by equipping a large part of our 52,000-sq.ft. plant with new machine tools.

Ours has been a peculiar business in that the element of decreasing our production was no part of our problem. The demand for our product has, contrary to usual experience, tended to increase during the depression rather than decrease. This was due to the fact that as the sale of new cars went down the need for repairs went up. It was only with the spring of 1935, with its great wave of new car buying, that our total business showed any decrease whatever, and this promises to be only temporary. Naturally, as new cars go on the roads in volume, repair business picks up.

Our products are used by the automobile repair garage chiefly for valve grinding, cylinder boring and piston turning. Our machines must have an accuracy which is equal to that which made the original parts for the automobile. It is important that the machine tools which we use in our manufacturing processes be of such a quality that this precision is built into the reconditioning equipment which we make.

We found on investigation that the machine tool builders had utilized the depression period to make marked improvements in the design and construction of their products and that because of the cost-reducing possibilities which the new tools held we could hold to our old prices and still build a better product.

After a thoroughgoing survey of our equipment and a care-



Motor pulley machining is speeded by the use of a modern turret lathe.

Jig costs, too, are reduced by means of a vertical milling machine

ful comparison of the market we bought seventeen new machines as listed below:

5 Warner & Swasey turret lathes
1 Carlton radial
1 Monarch toolroom lathe
1 Barnes honing machine
1 Barnes heavy duty drill
1 Avey two-spindle drill
1 Cincinnati grinder
1 Blanchard grinder
2 Milwaukee horizontal millers
1 Milwaukee vertical miller
1 Gallmeyer drill grinder
1 Micromatic hone

The result of these purchases, involving an investment of approximately $50,000, has been twofold. We have not been forced to increase prices, but in fact, have reduced the price on one of our machines, and we have increased the accuracy, sturdiness, general quality and money-making possibilities (from the customer's viewpoint) of all of them.

In connection with our manufacturing plant, we operate a large garage, where we try out our new equipment. It serves as a laboratory to obtain information concerning the operation of motors and to secure records of performance. This garage is also used as a source of new ideas; we operate it exactly as one of our customers operates his garage, taking in repair work just as he would. As a result, we know that every new machine we develop is one which has a definite place in the up-to-date garage; that it can be readily used by the average mechanic and that it will make money for its purchaser.

Two years ago hardened steel inserts, or alloys of some kind, were almost standard practice in all exhaust valve seats in new motors. Since most of these alloys were similar to high-speed steel (some were Stellite) it was impossible to cut them with the ordinary high-grade cutter. After lengthy experimentation, we succeeded in producing a hard seat grinder for this purpose. This grinder is mounted entirely on ball bearings and driven by a high-speed motor. A dial indicator gage, reading directly in thousandths of an inch, allows the operator to check the results of his work.

With these necessities for precision and accuracy the need for the most modern and the finest machine tools obtainable is readily apparent. With our new equipment we are able to secure this accuracy without sacrificing production economies. It is our belief that our new machine tool equipment because of these facts will pay for itself in about three and a half years.

New Light Weight Alloy

There's a new British nickel-aluminum alloy known as "Ceralumin C." It is copper 2.5, nickel 1.5, magnesium 0.8, iron 1.2, silicon 1.2, cerium 0.15 and aluminum 92.65, all being in per cent.

EDITORIALS

VOLUME 79 AMERICAN MACHINIST ESTABLISHED 1877 NUMBER 26

McGRAW-HILL PUBLISHING COMPANY, INC.

K. H. CONDIT • F. H. COLVIN
EDITORS

BLOW THE WHISTLE!

MISSISSIPPI sidewheelers have two engines, one for each paddle wheel. In each engine room is the usual gong and jingle bell from which the engineer gets his orders. Between the two engine rooms there is often a steam whistle.

In maneuvering his boat to avoid snags and sandbars in a swift current the pilot sometimes sends signals to one or both engine rooms so fast and furiously that the engineers become confused. Even the pilot himself occasionally gets somewhat mixed as to just what he has ordered, and what his engineers are doing.

Then he blows the whistle—which means "as you were." The engineers disregard all previous signals and wait for new ones.

This familiar Mississippi predicament has a close parallel in what is happening on the banks of an equally famous stream—the Potomac. There the White House is the pilot house and the ship is the Ship of State.

The stream of the late depression was deeper and more dangerous than any Mississippi eddy. Its current is still powerful and skillful piloting is vitally necessary.

The pilot in the White House has issued many contradictory orders, usually on the jingle bell for full speed ahead. Off gold, on silver. AAA to raise the prices the farmer gets, NRA to offset it by increasing the cost of what he buys. FHA insured loans to help industry, SEC restrictions to choke off its supply of private capital.

Lately he promised business a breathing spell. Last week his Coordinator of Industrial Cooperation called a meeting which was interpreted as an endeavor to hang a new NRA around its neck. Rather clear evidence that confusion continues, in the engine rooms and in the pilot house.

It is high time for the pilot to blow the whistle—or make way for one who will.

Better Patents

IN INDUSTRIAL circles the conviction is growing that our present patent procedure makes a patent about as much of a liability as it is an asset. A committee of the Science Advisory Board of the National Research Council has been studying the question and has just made its report.

Four definite recommendations are made, three positive and one negative. They are: That, when an application is ready for allowance, it be published in the Official Gazette, and the submission of pertinent facts by interested parties be invited;

That there be established a single Court for Patent Appeals, in order to establish and maintain harmony and accuracy in judicial interpretation of patent questions, by confining the appellate jurisdiction in civil patent causes to one court, composed of permanent judges having the necessary scientific or technical background;

That there be provided scientific or technical advisors or juries to furnish adequate scientific or technical assistance to courts of first instance in equity patent causes;

That no system of compulsory licensing be introduced at this time.

Since the metal-working industry is based largely on patents those officials concerned with this function should certainly give this report careful study. If they agree with its recommendations their support will help to get the necessary legislative action to correct an almost intolerable situation. If they see errors in the findings of the committee they should call attention to them lest they be carried into law and make a bad situation worse.

Chips

WASHINGTON — Roosevelt opens political campaign by vigorously defending the accomplishments of his administration . . . Hull warns unlicensed munitions dealers that they will be prosecuted . . . Munitions Board is sued by exporter because of its Italian policy . . . New Deal bureaucracy outgrows available office space and may have to spread to other cities . . . Supreme Court hears arguments on AAA and Bankhead Cotton Act cases . . . Cummings appears personally in Utility Act suit against Electric Bond & Share.

FOREIGN—Germany aggravates a bad financial situation by repudiating reichsmark notes held abroad . . . Italian bombing planes fail to get Haile Selassie in several attacks on Dessye as British and French strive to find peace formula acceptable to both belligerents . . . Japanese are warned by U. S. and Britain to observe treaty provisions in China . . . Japan says 9-power pact is obsolete . . . Navy parley opens in London with small hope of success, Japan demanding parity, Britain more ships, U. S. a 20 per cent cut . . . Unemployment rises seasonally in Germany as Nazi plan to get everyone employed this year falls short of its goal . . . Many nations demand damages from Nazis for harm done their nationals of Jewish extraction . . . Senator Lewis returns convinced Soviets will not pay Kerensky debt.

FINANCE—Advisory Council warns Eccles of serious danger if he does not cut enormous bank reserves . . . Failure of U. S. Treasury to support silver market in London precipitates crisis and drives price of silver down materially . . . Declarations of extra dividends mark close of year . . . Money stocks and excess reserves at new high records . . . Bankers Association president urges banks to take over credit facilities now handled by federal agencies.

INDUSTRY—Industrial leaders at N.A.M. congress draft vigorous platform which is promptly attacked by A. F. L. . . . Burlington strike avoided as management agrees to put two men in Zephyr cabs . . . Guffey Coal Act held illegal by Liberty League lawyers . . . Berry conference bolted by industry after steam roller methods cause wild confusion at opening session . . . Colby Chester of General Foods reports results of questionnaire to 8,000 who voted they did not like corporations that were too large even though they paid better wages . . . General Electric to continue its pension plan for those employees already enrolled . . . New York electricians' union is sued for conspiracy in restraint of trade by electrical manufacturers . . . Institute survey shows that 9 out of 10 steel executives rose from the ranks . . . P.R.R. orders 10,000 freight cars to cost $25,000,000 . . . Labor Board sues to force Greyhound Bus Lines to deal with unions . . . U.P. orders two diesel-electric, stream-lined trains from Pullman for the run between Denver and Chicago over U.P. and C.&N. tracks.

TRADE—China Clipper completes first commercial round trip flight to Manila several hours ahead of schedule . . . American, British, Irish and Canadian experts agree on plans for transatlantic air service . . . Farley moves to get funds for new mail service . . . General Motors sets automobile sales record in November.

INDICATORS — Steel production declines slightly . . . Electric power output at a new high for the year . . . *Business Week's* index rises strongly to 73.8.

Manufacturers Decry Federal Interference and Expenditures

NEW YORK—Collectively, manufacturers are tired of the New Deal. At least that was the impression obtained at the National Association of Manufacturers' "Congress of American Industry," held December 4 and 5 at the Hotel Commodore, New York.

Speaker after speaker rose to comment on one phase or other of government's intrusion into business. Consensus of opinion was that reemployment depended on continued improvement in private enterprise and that private enterprise is being hindered by federal interference and the higher taxes resulting from extravagant federal expenditures.

To leave no doubt as to its sentiments NAM adopted a platform, salient points of which appear on this page. Backing this platform were two committee reports, one on government finances and one on the relation of government to industry, the two points on which the Association took chief issue with current federal policy.

Guest speaker at the NAM annual dinner was Alfred P. Sloan, Jr., president, General Motors Corporation. Said Mr. Sloan, "industry must make itself responsible for such an economic balance among wages, selling prices and profits as will promote a soundly based and widely distributed well being."

Mr. Sloan's sentiments were indorsed by Dr. Harold G. Moulton, president, The Brookings Institution. Referring to studies made by the Institution on the general subject, "Distribution in Relation to Economic Progress," Dr. Moulton stated that we have not been suffering from general over-production and that we have not reached a point where it is possible to supply adequate standards of living for everybody. He recommended passing on to the consumer the benefits of technological progress, mass production and low unit cost rather than the use of such savings to swell profits at the expense of average national income.

Industry on the whole has neglected to tell its story to the people of the United States according to Bruce Barton, of Batten, Barton, Durstine & Osborn, Inc., who addressed one of the sessions. "Industry and politics, at the moment," he said, "are competitors for the confidence and favor of the same patron, the public. Politics know it; industry for three years has acted as if it did not." Later Mr. Barton suggested "that we stay away from Washington and attend to our work. . . . Why should we bother so much with the servants of the people when we can talk to the people themselves?"

Dr. Neil Carothers, director of the College of Business Administration, Lehigh University, in his address pointed out that the days of unrestrained laissez-faire are over. "It is not now a question of whether we shall have regulation or not," he said. "It is a question of what kind of regulation." Business, he contended, should submit to fair and unpartial regulatory measures, should resist government control and those interferences which are discriminating, punitive or politically corrupt.

The opening address of the Congress was delivered by Robert L. Lund, chairman of the board of directors, who reviewed some developments in the recent past and condemned some political efforts to restrict industry. He spoke particularly against the unbalanced budget, the contempt for the constitution of the United States and the deliberate firing of class hatred by certain office holders.

As retiring president of NAM, C. L.

Dinner Speaker

Underwood & Underwood, Washington

ALFRED P. SLOAN, JR.
President, General Motors

New NAM President

Underwood & Underwood, Washington

COLBY M. CHESTER, JR.
Chairman, General Foods

Principal Points in NAM Platform

- The only solution for unemployment is reemployment through the revival of private enterprise.
- The only means of bringing government spending down to a proper and reasonable maximum and of making the burdens of debt and taxation bearable, both by reduction in government spending and by increase in the incomes of all, is likewise through the revival of private enterprise.
- Confidence cannot be restored or maintained when government officials and legislators, in spite of their oaths of office, endeavor to avoid by technicalities the true intent of constitutional guarantees, or deliberately to legislate with respect to matters not delegated to them.
- No small group of men can possess the wisdom, foresight, and discernment required to plan, direct, and stimulate successfully the activities of all, nor will planning by political agencies be free from influences and motives unrelated to the questions before them.
- If government's efforts to substitute its planning for the individual enterprise system are pursued, private enterprise cannot be revived and again be able to give employment to those seeking gainful occupations.
- Government spending without provision for its financing except by a constantly expanding public debt, postpones the day of reckoning, unfairly passes the burden of taxation on to the future and arouses fear of impending disaster.
- This American System has not failed. It has not collapsed. It did not break down in depression because of weaknesses or evils inherent in the System.

Bardo spoke on "Looking Forward," in which he predicted survival of the capitalistic system and continuance of free industrial enterprise and economic development.

In addition to 45 state directors representing 22 states, the following directors-at-large were elected.

Vincent Bendix, president, Bendix Brake Co., W. Gibson Carey, Jr., president, Yale & Towne Mfg. Co., S. Bayard Colgate, president, Colgate-Palmolive-Peet Co., F. B. Davis, Jr., president, United States Rubber Co., H. L. Ferguson, president, Newport News Shipbuilding & Dry Dock Co., Tom M. Girdler, chairman, Republic Steel Corp., Charles R. Hook, president, American Rolling Mill Co., George H. Houston, president, Baldwin Locomotive Works, F. W. Lovejoy, president, Eastman Kodak Co., Malcolm Muir, president, McGraw-Hill Publishing Co., J. W. Phelps, president, American Can Co., Ernest T. Weir, president, National Steel Corp.

Great Lakes Exposition for Cleveland Centennial

To celebrate Cleveland's centennial in 1937, a great industrial exposition will be held during the months of July, August and September. Officially known as the Great Lakes Exposition, the undertaking will cover 80 acres of downtown lakefront and a minimum attendence of 4,000,000 persons is expected. A fund of $1,000,000 is now being underwritten. Among the committee members are the following machinery men: J. F. Lincoln of the Lincoln Electric Co.; L. W. Grove of the Cleveland Pneumatic Tool Co.; P. E. Bliss of Warner & Swasey Co.; Fred H. Chapin of National Acme Co. It is planned to have a constantly changing list of attractions.

Technological Survey To Be Made by WPA

As part of the national research program of the Works Progress Administration, the first project set up is a study of "the effects of recent changes in the techniques of production on the volume of employment and unemployment." This work is under the supervision of Corrington Gill, assistant works progress administrator. He has appointed David Weintraub with offices at 12 South Twelfth St., Philadelphia, Pa., as director of the first study which is entitled "Reemployment Opportunities and Recent Changes in Industrial Techniques." It is expected that a report will be issued after a year's work.

The study under Mr. Weintraub's direction has several objects. The first is a measurement of the volume of technological unemployment; in other words, the approximate number of technologically unemployed workers. The second part is designed to find the changes in productivity in selected groups of industries, and this work will be done in cooperation with the U. S. Department of Labor along the lines already established by that bureau.

Machine Tool Orders Hold in November

Domestic machine tool business during November was maintained at the level generally prevailing since last June. The index was 79.2, practically equivalent to October's.

Because of the progressive decline in foreign orders, the total index did not fare so well. At 98.6 it shows a loss of 4.2 per cent from the previous month. It is true that foreign orders were an abnormally high percentage of the total during the summer months. They reached a peak index of 47.6 in August or 37 per cent of the total business done. In September they were 32 per cent, in October 23 per cent, and in November 19.4 per cent. The trend in foreign orders may go lower, but at least they are now in a more reasonable position than a few months ago.

The three-months' moving average was also pulled down by the decline in foreign business. The peak occurred in August, then being 112.2 but now the index is below 100, standing at 93.8.

The smaller companies—Group B, Table II—have enjoyed a relatively better level of business since July than the concerns in Group A. Of course, their dollar volume is on an entirely different plane. If for the two groups the total indexes for the period July-November are averaged, it is found that the Group B companies have an average total index of 112.9 as compared with 104.9 for the Group A concerns. Domestic business of Group B rose 8 per cent in November, while the Group A index dropped 0.8 point.

Table I—Index of Orders Based on Volume of Shipments for 1926

Month	Index of Orders: Domestic	Index of Orders: Foreign	Index of Orders: Total	3 Months' Average Index	% Foreign to Total Orders
1935—May	57.3	16.0	73.3	67.1	21
June	75.5	15.6	91.1	76.7	17
July	82.5	37.3	119.8	94.7	31
August	78.2	47.6	125.28	112.2	37
September	54.1	25.9	80.0	108.5	32
October	79.5	23.4	102.9	102.9	23
November	79.2	19.4	98.6	93.8	19

Table II—Index of Orders—By Size of Companies

Group A—Companies reporting year's sales in 1926 of $200,000 or more:

Month	Index of Orders: Domestic	Index of Orders: Foreign	Index of Orders: Total	No. of Reports	% Foreign to Total Orders
1935—May	57.3	16.7	74.0	83	23
June	76.0	16.0	92.0	88	17
July	80.3	38.8	119.1	87	33
August	77.2	49.3	126.5	85	39
September	53.0	27.0	80.0	87	34
October	78.2	23.9	....	86	23
November	77.4	19.7	97.1	84	20

Group B—Companies reporting year's sales in 1926 of less than $200,000:

1935—May	57.3	3.2	60.5	55	5
June	68.1	10.9	79.0	69	14
July	117.6	13.8	131.4	62	10
August	95.4	19.1	114.5	58	17
September	72.0	7.8	79.8	63	10
October	101.6	13.4	115.0	61	12
November	109.9	13.7	123.6	60	14

Table III—Distribution of Orders

(Shown by indexes of individual companies)

New Orders in % of 1926 Shipments	Number of Reports in Each Index Group: May	June	July	August	September	October	November
200 or more	6	14	31	22	10	19	13
100–199	21	31	35	33	30	31	38
90–99	8	8	5	3	7	7	6
80–89	3	8	7	6	5	12	3
70–79	11	10	8	5	4	11	7
60–69	6	10	8	10	8	6	10
50–59	8	5	14	10	14	10	15
40–49	9	7	9	12	11	6	5
30–39	11	15	7	8	22	11	8
20–29	15	15	9	10	14	14	11
10–19	11	14	6	9	8	8	11
Less than 10	29	20	10	16	17	12	17
Total Reports	138	157	149	144	150	147	144

Industry Unable to Absorb the Unemployed

That industry can not alone provide employment for the 11,000,000 unemployed was the burden of the talk given by William J. Cameron, spokesman for the Ford Motor Company, during the company's regular Sunday night broadcast on Dec. 15. His purpose was to answer the demand credited to certain government circles that industry employ immediately an additional 11,000,000 persons or take the consequences. Mr. Cameron said that industry normally employs fewer than 9,000,000 persons, of whom 7,000,000 are probably now at work, and that there never had been enough purely industrial work to provide employment for 20,000,000 people, even though the government should arbitrarily command that the unemployed be put to work immediately by industry. He also said that industry employs only one-quarter of the nation's workers.

Westinghouse Jubilee Starts on January 8

Short-wave radio as a means of holding a mass meeting of all employees both here and abroad will be used for what is thought to be the first time during the 50th anniversary celebration of the Westinghouse Electric & Mfg. Company. On the night of January 8 the 12,000 employees in the Pittsburgh district will hear Chairman A. W. Robertson and President F. A. Merrick as well as others on a two-hour program. The program will be sent by the company's short-wave transmitter W8XK to meetings of employees at every other important Westinghouse plant or office in the country. Friends and employees abroad will hear the program, as well as persons in the United States possessing short-wave receivers.

Lewis M. Lind Heads Machinery Division

Lewis M. Lind of Lake County, Ohio, has been appointed acting chief of the Machinery Division, Bureau of Foreign and Domestic Commerce. He succeeds R. E. W. Harrison, resigned. Mr. Lind is the son of Herman H. Lind, general manager of the National Machine Tool Builders Association. He handled many machinery codes during the NRA period.

Noisy Session Inaugurates Major Berry's Coordinatorship

WASHINGTON—If the President could have foreseen the results of the first major effort undertaken by his recently appointed Coordinator for Industrial Cooperation, he would certainly have chosen a less ironic title. No one who attended the conference called by Major George L. Berry at Washington, December 9, would rate him highly either in coordination or cooperation.

Perhaps the set-up was wrong from the start. Business men felt, with good cause, that here was a move to lay the groundwork for a restoration of the first abortive attempt at government control of industry experienced under NIRA. Those who sat in at the meeting did not come with the naive willingness to enter into partnership with the administration that marked the early days of Hugh Johnson's regime.

The general feeling was that the conference was ill-timed, but if the Administration wanted to hold it, it should have called upon a prominent Democrat like Newton D. Baker or Owen D. Young, in whom business would have confidence. Major Berry's strong labor affiliations put him and his program under a severe handicap.

The distrust attending the announcement of his plans was sufficient to draw official refusal to participate from many of the important industrial groups, such as the Automobile Manufacturers Association, the American Iron and Steel Institute, the National Association of Manufacturers, the National Lumber Manufacturers Association and the National Electrical Manufacturers Association. The Machinery and Allied Products Institute took the other stand, that industry should be represented in order to present its case in the proper light.

Industrial Review

• Although certain industrial centers report continued good business in December the general situation seems to be that the usual year-end slackening off is taking place. Inquiries are still coming in and there is every prospect that 1936 activity will be on a decidedly higher level than that of 1935.

• Inquiries are good in the New England territory although orders are down somewhat. Distributors expect that many sales will be booked after January 1. New York also reports a slowing down in closing although plenty of inquiries are being worked upon. In Philadelphia orders and inquiries are fairly good and the trend is apparently upward. Pittsburgh distributors are encouraged by the steadiness with which orders are coming in. The volume is not large but it is expected to grow after the holidays.

• Despite a dropping off in Cleveland business during the past fortnight December 1935 will be well ahead of December 1934. The labor situation seems to be better than it has been for some time. In Detroit orders and inquiries for small tools and supplies are increasing steadily. Orders for machine tools, on the other hand, are not materializing as rapidly as possible and the expectation is that there will be a rush after the first of the year. Inquiries have fallen off in Toledo but there is still considerably more business in prospect than there was at this time last year. The labor situation is improving.

• The outlook in Cincinnati is encouraging. Inquiries continue and orders are being placed although the volume is down somewhat. No labor difficulties are in sight at the moment. Business continues on a satisfactory level in St. Louis, the electrical manufacturers and tool and die shops being especially busy.

• December will be unusually good in Chicago despite a certain amount of slowing down for the holidays. There is no general labor disturbance but manufacturers are complaining of their inability to get good mechanics. Milwaukee reports a considerable slowing down in December. The labor situation has not been helped by the city ordinances authorizing the authorities to close down plants where there are strikes. A threatened machinists' and tool and die makers' strike scheduled for the first part of January is making things uneasy in the area around San Francisco. Machine tool business will probably be dull until after January 1.

Well publicized in the daily press was the riotous first session. Major Berry opened with an address outlining the need for further reemployment, telling his plans for round-table meetings and the selection of delegates to an industrial council. These remarks did not specifically name the objectives of the meeting nor the procedure to be followed.

At the conclusion of Major Berry's talk, MAPI President John W. O'Leary attempted to obtain recognition from the chair but was denied by the Major who declared the meeting adjourned. Thereupon Dr. A. P. Haake, secretary of the National Furniture Association, demanded that Mr. O'Leary be given an opportunity to speak. Major Berry refused again and accused Dr. Haake of attempting to disrupt the meeting. The lie was passed between them with resultant disorder. Major Berry refused employers in attendance permission to hold an independent meeting but later turned over the Department of Labor Auditorium to a labor meeting called by A. F. of L. President Green.

Major Berry's conduct led many industrialists to suspect that he was employing steam-roller methods to achieve his ends by denying free discussion of the issues involved. The result was that a majority of the 44 round table meetings refused to elect delegates.

In a statement following the initial session, Mr. O'Leary told of the points he wished to raise at the meeting. He contended that the plan of organization should have been freely discussed before breaking up into groups.

Majority Oppose an NRA

According to Mr. O'Leary, a poll made within the last few weeks revealed that of more than 10,000 employers replying 82 per cent were flatly opposed to any continuation of the principles of NRA, these 82 per cent representing more than half of the wage earners in manufacturing industries.

Superficially undismayed Major Berry, according to latest reports, plans to call his industrial council for a meeting this week. In this he has the encouragement of labor groups. Obviously such a council cannot be representative of industry in view of its lopsided make-up. Major Berry's contention that 27 industries selected spokesmen is misleading so far as his original 44 groups are concerned. In only two or three of these groups was there a fair representation of industry, and those that took any action at all contented themselves for the most part with appointing "observers" or drafting statements of their views.

Parts Commitments Extended As Auto Output Continues at High Rate

DETROIT—The chief indoor sport of the automotive industry at the present time is a close scrutiny of sales, registration and production figures. This interest is not alone to evaluate the effect of the earlier introduction date this year, but to estimate the likely effect on the usual spring peak from the standpoint of material commitments.

With every indication that November and December will show higher sales and production figures than ever before in the industry, parts and material commitments are just now being extended to April 1, and in one case to July 1 at present prices. Finished steel prices are not expected to increase for the first quarter, but suppliers are covering in steel at going prices for these extensions in assembly plant orders. Cold-rolled strip prices broke $3.00 per ton last week as a result of western mill competition in the Detroit market.

Sales Records Continue

Survey of parking lots around factory buildings indicates that new cars are appearing in quantities for the first time in several years. With a more even employment curve in 1935 than in previous years, this is anticipated to grow in volume. Production in October was 283,344 for this country and Canada, while 390,000 is estimated for November. October sales totalled, exclusive of Canada, 186,630 units and November is anticipated to exceed 200,000 units by a considerable margin. New car sales in Detroit during November were higher than in any previous introductory month, 10,740 being delivered. Packard deliveries in November exceeded the same month in 1928, its best year, by 1,800 units. Since the introduction of '36 models in September, Buick has delivered 32,253 cars as against 46,431 during the first eight months of the year. Chrysler and Plymouth deliveries are also at record levels. Pontiac is producing at the rate of 1,000 per day with a likelihood of doubling '35 retail deliveries over those of '34. Dodge is turning out 1,100 per day with two shifts. The 60,707 units delivered by Chevrolet during the first twenty days of November is nearly three times as great as the best post-announcement twenty days since 1928. Total November retail sales were 91,959 units.

Foundries supplying castings for dies have not as yet felt the impetus of '37 business. It is customary for heavy castings orders to be placed several months in advance of real preparation time. Business in this industry was unusually good this year, the busy period running seven months from March to the end of September. Flat work, pads and beds were expected to be let during November but are now anticipated for the middle or last of December. Indications point to substantial changes in models for the coming year which should mean an extensive die program.

Deliveries of machinery have not greatly improved as to time. The main activity at present seems to be in getting machines sold for current production to operate satisfactorily. There are some inquiries for heavy, long-delivery machines for '37 production. This sort of business is anticipated to increase greatly in volume after the first of the year since, barring a change in the November introduction date next year, plants will plan to be in production during late September. While generally machinery sales are quiet, some dealers are reporting purchases for cost-reduction purposes.

The apprenticeship program sponsored by the National Metal Trades Association of Detroit and several leading industries to replenish existing shortages in skilled workers is progressing rapidly. Thirty companies will be actively cooperating in this plan by January 1.

With the employment index for Detroit, as of November 30, higher than for any similar season since 1928, the labor situation displays mixed tendencies. With the exception of Motor Products, there is no visible difficulty. A meeting called by union members last week in a plant employing between 10,000 and 15,000 workers was attended by less than 100 workers. Of this number 20 voted to call a strike.

Lewis' Organizers in Detroit

It is reported that, under the leadership of the United Mine Workers, agents are in Detroit in the attempt to build up recruits for industrial unions as opposed to craft unions. Decision in the Fruehauf case, the first held in this area, under the new Wagner bill has not been announced by the Labor Board. This case involved claimed discrimination against union members in a layoff. The Bendix Corporation has been ordered by the Board to hold elections to determine the group to represent the employees as a bargaining agency.

Fred M. Zeder Will Speak at S. A. E. Annual Meeting

Some 37 authors are on the tentative program for the annual meeting of the Society of Automotive Engineers at the Book-Cadillac in Detroit, Jan. 13-17. The many divisions of the society will each be interested in one or several papers on the five-day program. Very little overlapping of papers is evident and not only will those who attend get to most papers but there will be ample time for them to join in the discussions. At a dinner meeting Thursday Fred M. Zeder, vice-president, the Chrysler Corp., will give the principal address "The Engineer—His Place in Management." Presentation of the following awards will be made: Daniel Guggenheim medal, Vincent Bendix trophies, and the Wright and Manly medals.

Tentative Program of S.A.E. Annual Meeting, Jan. 13-17

MONDAY

10:00 a.m. Transportation and Maintenance

The Operator's Woes in Lubrication by F. L. Faulkner, Armour & Company

2:00 p.m. Truck, Bus and Railcar

Trends in Automotive Alloy by A. E. White, University of Michigan

8:00 p.m. Student Session

Demonstration and talk "The Story of Ethyl Gasoline" by F. R. Speed, Ethyl Gasoline Corp.

TUESDAY

10:00 a.m. Traffic Safety

Customer Research by H. G. Weaver, General Motors Corp.

The Traffic Safety Problem by Miller McClintock, Harvard University

2:00 p.m. Chassis

Suspensions by W. R. Griswold, Packard Motor Car Company.

Air Springs—Tomorrow's Ride by R. W. Brown, The Firestone Tire & Rubber Company.

2:00 p.m. Diesel Engine and Fuels and Lubricants

Cetane Rating and Diesel Fuels by P. H. Schweitzer and T. B. Hetzel, Pennsylvania State College.

Report of Volunteer Group for C. I. Fuel Research by T. B. Rendel, Shell Petroleum Company.

Diesel Fuels—Plain or Fancy? by J. R. McGregor, Standard Oil Company of California.

7:45 p.m. Business Session

Nomination and Election of Members-at-Large of Annual Nominating Committee.

Announcement of Election of Officers for 1936.

8:00 p.m. Future Cars

Symposium with papers by A. M. Wolf, Automotive consultant, N. Y.; Herbert Chase, consulting engineer, N. Y.; A. E. Northrup, Murray Corp of America, and W. B. Stout, Stout Engrg. Labs., Inc.

WEDNESDAY

10:00 a.m. Cylinder Wear

Cylinder Wear, Where and Why, by S. W. Sparrow and T. A. Scherger, the Studebaker Corp.

Diesel Engine Problems by O. D. Treiber, Hercules Motors Corp.

10:00 a.m. Passenger-Car Bodies

Problems of Radical Body Design by E. L. Johnston, Stout Motor Car Corp.

Body Construction of the Cord Front Wheel Drive by E. L. Allen, Auburn Automobile Company.

2:00 p.m. Cylinder Wear

Aircraft-Engine Problems by Robert Insley, United Aircraft Mfg. Corp.

The Effect of Gas Pressure on Piston Friction by M. P. Taylor, formerly graduate student, Massachusetts Institute of Technology.

8:00 p.m. Production

The Place of Die Casting in Automotive Design by J. C. Fox, Doehler Die Casting Company.

Custom Building Production Cars by V. P. Rumely, Hudson Motor Car Company.

Metallurgy of Transmission Gears by R. B. Schenck, Buick Motor Company.

THURSDAY

10:00 a.m. Engines

Fuel Consumption by Alex Taub, Chevrolet Motor Company

Engine Roughness—Its Cause and Cure by P. M. Heldt, Automotive Industries.

10:00 a.m. Aircraft

Everyman's Airplane—A Development Toward Simpler Flying by F. E. Weick, National Advisory Committee for Aeronautics.

Smart Airplanes for Dumb Pilots by Otto Koppen, Massachusetts Institute of Technlogy.

2:00 p.m. Fuels and Lubricants and Passenger Cars

Relation of Exhaust Gas Composition to Air-Fuel Ratio by B. A. D'Alleva and W. G. Lovell, General Motors Corp.

Thermodynamics of Volume Distribution by R. L. Sweigert, Georgia School of Technology.

2:00 p.m. Aircraft

Engine Nacelles and Propellers, and Airplane Performance by D. H. Wood, National Advisory Committee for Aeronautics.

7:00 p.m. Dinner

Detroit Section Acting as Host to the National Society: Peter Altman, Chairman Detroit Section, Malcolm Bingay, Toastmaster.

"The Engineer—His Place in Management" by F. M. Zeder, Chrysler Corp.

W. B. Stout, president, R. R. Teetor, president-elect. Presentation of the: Daniel Guggenheim Medal, Vincent Bendix Trophies, Wright and Manly Medals.

FRIDAY

10:00 a.m. Aircraft Engine

Fuel Consumption: The Operator's Viewpoint by E. T. Allen, Consulting Aeronautical Engineer.

Engine Possibilities and Devices for Obtaining Best Fuel Economy by R. W. Young, Wright Aeronautical Corp.

2:00 p.m. Aircraft Engine

Eliminating Torsional Vibration in the Radial Aircraft Engine by E. S. Taylor, Massachusetts Institute of Technology.

Carburetor Icing by W. A. Hamilton, Transcontinental and Western Air, Inc.

PERSONALS

E. S. CHAPMAN, who has held various positions with the Chrysler Corp. since joining it in 1928, is now general works manager of the Plymouth Motors Corp. He has had charge of parts manufacture at Newcastle, Ind., has headed the Amplex division and managed the Airtemp Corp., a Chrysler subsidiary, as vice-president and general manager.

AMBROSE SWASEY, dean of American machine tool builders, a founder of the Warner & Swasey Co. and now chairman of the board, will be 89 on Dec. 19. He will be honored by an informal luncheon at the plant. Guests will be shown the 82-in. telescope being built for the McDonald observatory.

KENNETH H. CONDIT, Editor, *American Machinist*, has been elected chairman of the standing committee on professional divisions of the American Society of Mechanical Engineers. The purpose of this committee is to coordinate and to promote the activities of the fifteen professional divisions of the society.

OBITUARIES

ROBERT C. SWAYZE, formerly vice-president of the Hendey Machine Co., Torrington, Conn., died Dec. 3, in his 64th year. Mr. Swayze had been at various times a director of the Union Hardware Co., Torrington Co., Plume & Atwood Co., and assistant treasurer of the Turner & Seymour Mfg. Co.

GEORGE P. SPEAR, general manager of the Corbin Screw Corp. and a vice-president of the American Hardware Co. before his retirement last March, died Dec. 6 in New Britain, Conn., at the age of 68.

JOEL F. TROUTMAN, 62, president of the Conduit Electric Co., Syracuse, N. Y., died in a local hospital Dec. 3, following an operation. He was formerly associated with the H. H. Franklin Mfg. Co., and H. A. Smith & Co.

C. H. FRANKLIN, one of the organizers and secretary-treasurer, the Macklin Co., Jackson, Mich., was killed recently in an automobile accident.

R. L. HILL, sales engineer of the Union Drawn Steel Co., Massillon, Ohio, was killed in an automobile accident at Toledo on Dec. 3. Mr. Hill had a wide acquaintance among machine tool users and had gained a reputation as authority on automatic screw machine operation. He had been connected with the Willys-Morrow Co. and the National Acme Co.

J. M. HIGHDUCHECK

BUSINESS ITEMS

American Cutting Alloys, Inc., 347 Madison Ave., New York, manufacturers of "Cutanit" tips and tools, has appointed as district manager for the mid-western territory J. M. HIGHDUCHECK, formerly supervisor of cutting tools and applications for the Westinghouse Electric Mfg. Co. Mr. Highducheck is one of the pioneers in the use of cemented carbide tools and has contributed to *American Machinist*.

Triplex Machine Tool Co., 125 Barclay St., New York, has opened a branch office at 20 Fern St., Auburndale, Boston, Mass., under the management of FRANK A. PARKER. He has been with the Jones & Lamson Machine Co. and the Hill-Clark Machine Co. RAY E. STERLING, for many years with the National Acme Co., has also been added to the Triplex sales force. He can be reached at P.O. Box 745, Meriden, Conn.

The Eclipse Counterbore Co., Detroit, has appointed J. E. MACARTHUR as assistant general manager in charge of national sales and service. Mr. MacArthur started as an apprentice at Brown & Sharpe and has held executive positions with Pierce Arrow, General Motors of Canada, and lately with Kearney & Trecker. Local and Michigan sales are handled by A. SUBIA.

Appointment of GEORGE R. WOODS, 17 Battery Place, New York, as American representative for chrome hardening processes and patents has been announced by H. VAN DER HORST of Ingenieurbureau "Lemet Chromium," Hilversum, Holland.

Sesamee Lock Co., Hartford, Conn., manufacturers of keyless locks, formerly located on Capitol Avenue, has taken over the Automatic Refrigerating Co.'s factory at the corner of Laurel St. and Capitol Ave. New location gives added floor space. PORTER B. CHASE is president and manager, and recently acquired the controlling interest in the company.

Foote Gear Works, Inc., 1301 South Cicero Ave., Cicero, Ill., has appointed Young & Vann Supply Co., 1725 First Ave., Birmingham, Ala., as exclusive representatives for Alabama and northwestern Florida.

EXPORT OPPORTUNITIES

Brewery equipment, including bottling machine and bottle washing machine (Purchase). Wellington, New Zealand. *9786.

Cutting machinery for leather shoe soles (Purchase). London, England. *9781.

Furniture manufacturing machinery (Purchase). Managua, Nicaragua. *9784.

Lacquer-testing machines (Purchase). The Hague, Netherlands. *9806.

Mining and transmission machinery (Purchase and agency). Melbourne, Australia. *9805.

Printing equipment and machinery. (Agency). London, England. *9783.

Rubber-working machinery for making vacuum-brake hose and rubber matting (Purchase). Birmingham, England. *9785.

Rubber-working machinery for reclaiming rubber from old tires (Purchase). Ponce, Porto Rico. *9788.

Sugar-mill machinery (Agency). Port of Spain, Trinidad. *9804.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office.

MEETINGS

AMERICAN ENGINEERING COUNCIL. Annual meeting, Jan. 9-11, Washington, D. C. FREDERICK M. FEIKER, executive secretary, 744 Jackson Place, Washington, D. C.

AMERICAN MANAGEMENT ASSOCIATION. Conference on personnel and industrial relations, Feb. 5-6. Palmer House, Chicago. Association headquarters, 20 Vesey St., New York.

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual meeting, Jan. 13-17, 1936. Book Cadillac Hotel, Detroit, Mich. JOHN A. C. WARNER, secretary, 29 West 39th St., New York, N. Y.

PATENTS

November 26, 1935

Metal-Working Machinery

Gear Grinder. Hubert D. Tanner, West Hartford, Conn., assigned to Pratt & Whitney Co. Patent 2,022,061.

Convertible Upright Drill. Lawrence L. Schauer and Augustus M. Sosa, Cincinnati, Ohio, assigned to the Cincinnati Bickford Tool Co. Patent 2,022,436.

Head and Spindle Counterbalance. Lawrence L. Schauer and Augustus M. Sosa, Cincinnati, Ohio, assigned to the Cincinnati Bickford Tool Co. Patent 2,022,437.

Hydraulically Operated Grinding Machine. Carl G. Flygare and Wallace H. Wood, Worcester, Mass., assigned to Norton Co. Patent 2,022,542.

Grinding of Rotating Eccentric Knives. Walter Everett Molins, Deptford, London, England. Patent 2,022,569.

Method and Machine for Finishing Screw Heads. Vincent James Roddy, Providence, R. I., assigned to American Screw Co. Patent 2,022,573.

Controlling Means for Flying Shears or the Like. Hans L. Schreck, Easton, Pa., assigned to Treadwell Engineering Co. Patent 2,022,574.

Tools and Attachments

Die for Two-Roll Corrugating Machines. Joseph C. Fisher, near Celina, and Edward A. Kiefer, New Bremen, Ohio, assigned to The Streine Tool & Manufacturing Co. Patent 2,022,082.

Screw Thread Gauge. Charles M. Pond, Hartford, Conn., assigned to Pratt & Whitney Co. Patent 2,022,089.

Tool Holder. Walter Knapp, Lancaster, Pa. Patent 2,022,288.

Tool Holder. Walter Knapp, Lancaster, Pa. Patent 2,022,289.

Work Guide and Withdrawal Regulator for Stamping Machines. Frank Ackerman, New York, and Herman Gould, Brooklyn, N. Y. Patent 2,022,365.

Metal Cutting Means and Method. Ralph R. Roemer, Cleveland, Ohio. Patent 2,022,433.

Processes

Fabrication of Nut Blanks. William G. Cist'n, Pittsburgh, and William M. Horton, Sewickley, Pa., assigned to Pittsburgh Screw & Bolt Corp. Patent 2,022,076.

December 3, 1935

Metal-Working Machinery

Grinding Wheel Feeding Mechanism. Albert G. Belden and Herbert A. Silven, Worcester, Mass., assigned to Norton Co. Patent 2,022,646.

Means for Spinning Metal. John M. Wyer, Bradmore, England, assigned to The Midland Metal Spinning Co., Ltd. Patent 2,022,797.

Metal Bending Machine. Otto H. Jensen, Detroit, Mich., assigned to Ternstedt Manufacturing Co. Patent 2,022,915.

Open Die Header. Charles T. Brennan, Cheshire, Conn. Patent 2,023,042.

Setting Head for Machines for the Grinding of Worms. Gabriel Lechesne, Montreuil-sous-Bois, France, assigned to Paul Durand. Patent 2,023,329.

Tools and Attachments

Adjustable Cylinder Hone. Fred M. Kern and Kirke W. Conner, Detroit, Mich., assigned to Micromatic Hone Corp. Patent 2,023,082.

Processes

Sheet Metal Yoke and Process of Making Same. Edward A. Conner, Stratford, Conn., assigned to American Chain Co., Inc. Patent 2,022,801.

Method of and Apparatus for Brazing. Frank T. Cope, Salem, Ohio, assigned to The Electric Furnace Co. Patent 2,023,354.

Furnaces

Stock Support for Heating Furnaces. John Wilson Corriston, Springfield, Pa. Patent 2,022,649.

American Machinist

REFERENCE BOOK SHEET

Bore Gaging by Rock of the Pin Gage

J. I. HOMMEL
Standards Engineer,
Westinghouse Electric & Manufacturing Company

Measuring the size of a bored hole to the exact thousandth of an inch can best be done by means of a plug gage, but such a gage is not always available. Correct plug gages are not only very expensive, but it takes time and special skill to manufacture them to precise limits and it is not always expedient to wait. A pin gage, on the other hand, is comparatively simple, and therefore can be procured quickly and at little expense.

In order to determine, for instance, the bore of a bearing which generally is oversize so as to permit a running clearance, the length of the pin gage is made the same as the shaft diameter. After measuring the rock of the pin gage, the clearance may be found in Table I (expressed in thousandths of an inch).

Example: The measurement of a nominal 6-in. bearing bore shows 0.410 in. rock. The table specifies 0.003 in. clearance for 0.379 in. rock and 0.004 in. clearance for 0.438 in. rock. By interpolation 0.410 in. rock results in a clearance of 0.0035 in.

Table 2 is used where the bore is undersize, such as may be the case when a press fit is required. The pin for such bores is made 0.01 in. less than the shaft.

Example: For a 5-in. diameter shaft the pin is made 4.99 in. long. Assuming a rock of 0.44 in., Table 2 shows 0.42 in. rock as indicating 0.0055 in. press fit, 0.45 in. rock as 0.005 in. press fit. Therefore, 0.44 in. rock would by interpolation be equivalent to a 0.0052 in. press fit.

Table I—Bearing Clearance by the Rock of the Pin Gage

Shaft Dia. or Length of Pin Gage	ALLOWANCES																				
	0.0005	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010	.011	.012	.013	.014	.015	.016	.017	.018	.019	.020
	ROCK OF PIN GAGE IN BORE																				
3	.110	.155	.219	.268	.309	.346	.379														
4	.126	.179	.253	.310	.357	.399	.437	.472													
5	.141	.200	.283	.346	.400	.447	.489	.528													
6	.155	.219	.310	.379	.438	.489	.536	.579	.619												
7	.167	.237	.334	.410	.473	.529	.579	.625	.668	.709											
8	.179	.253	.358	.438	.506	.565	.619	.669	.715	.758	.799										
9	.190	.268	.379	.465	.536	.600	.657	.709	.758	.804	.847										
10	.200	.283	.400	.490	.565	.632	.692	.748	.799	.848	.893	.937									
11	.210	.297	.419	.514	.593	.663	.726	.784	.838	.889	.937	.983	1.026								
12	.220	.310	.438	.536	.619	.693	.759	.819	.876	.929	.979	1.028	1.072	1.116							
13	.229	.322	.456	.558	.645	.721	.789	.853	.911	.967	1.019	1.069	1.116	1.161	1.205						
14	.236	.335	.473	.579	.669	.748	.819	.885	.946	1.003	1.057	1.109	1.158	1.205	1.251	1.294					
15	.245	.347	.490	.600	.693	.774	.848	.916	.979	1.039	1.095	1.148	1.199	1.248	1.295	1.340					
16	.253	.358	.506	.620	.715	.800	.876	.946	1.011	1.073	1.131	1.186	1.238	1.289	1.337	1.384	1.429				
17	.261	.368	.522	.639	.737	.824	.903	.975	1.042	1.106	1.165	1.222	1.276	1.328	1.379	1.427	1.473	1.519			
18	.269	.379	.536	.657	.758	.848	.929	1.008	1.073	1.138	1.199	1.258	1.313	1.367	1.418	1.468	1.516	1.563	1.608		
19	.276	.390	.551	.675	.779	.871	.955	1.031	1.102	1.169	1.232	1.292	1.350	1.404	1.457	1.509	1.558	1.606	1.652	1.697	
20	.283	.400	.565	.692	.800	.894	.979	1.057	1.131	1.199	1.264	1.326	1.385	1.441	1.495	1.548	1.598	1.648	1.695	1.742	1.787

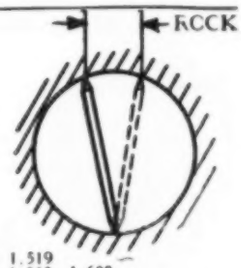


Table II—Press Fit by the Rock of the Pin Gage

DIAMETER OF SHAFT	LENGTH OF PIN GAGE	PRESS FIT ALLOWANCES—In Thousandths of an Inch															
		LESS 9	LESS 8	LESS 7	LESS 6½	LESS 6	LESS 5½	LESS 5	LESS 4½	LESS 4	LESS 3½	LESS 3	LESS 2½	LESS 2	LESS 1½	LESS 1	LESS ½
3	2.99	.16	.22	.27	.29	.31	.33	.35	.36	.38	.39	.41	.42	.44	.45	.46	.48
3½	3.49	.17	.24	.29	.31	.33	.35	.37	.39	.41	.42	.44	.46	.47	.49	.50	.51
4	3.99	.18	.25	.31	.33	.36	.38	.40	.42	.44	.46	.47	.49	.51	.52	.54	.55
4½	4.49	.19	.27	.33	.35	.38	.40	.42	.44	.46	.48	.50	.52	.53	.55	.57	.58
5	4.99	.20	.28	.35	.37	.40	.42	.45	.47	.49	.51	.53	.55	.56	.58	.60	.62
5½	5.49	.21	.30	.36	.39	.42	.44	.47	.49	.51	.53	.55	.57	.59	.61	.63	.64
6	5.99	.22	.31	.38	.41	.44	.46	.49	.51	.54	.56	.58	.60	.62	.64	.66	.67
6½	6.49	.23	.32	.39	.43	.46	.48	.51	.53	.56	.58	.60	.62	.64	.66	.68	.70
7	6.99	.24	.33	.41	.44	.47	.50	.53	.55	.58	.60	.63	.65	.67	.69	.71	.73
7½	7.49	.24	.35	.42	.46	.49	.52	.55	.57	.60	.62	.65	.67	.69	.71	.73	.75
8	7.99	.25	.36	.44	.47	.51	.54	.57	.59	.62	.65	.67	.69	.72	.74	.76	.78
8½	8.49	.26	.37	.45	.49	.52	.55	.58	.61	.64	.66	.69	.71	.74	.76	.78	.80
9	8.99	.27	.38	.47	.50	.54	.57	.60	.63	.66	.68	.71	.73	.76	.78	.80	.83
9½	9.49	.28	.39	.48	.52	.55	.58	.62	.65	.67	.70	.73	.75	.78	.80	.83	.85
10	9.99	.28	.40	.49	.53	.57	.60	.63	.66	.69	.72	.75	.77	.80	.82	.85	.87
10½	10.49	.29	.41	.50	.54	.58	.61	.65	.68	.71	.74	.77	.79	.82	.84	.87	.89
11	10.99	.30	.42	.51	.55	.59	.63	.66	.70	.73	.76	.78	.81	.84	.86	.89	.91
11½	11.49	.30	.43	.52	.57	.60	.64	.68	.71	.74	.77	.80	.83	.86	.88	.91	.93
12	11.99	.31	.44	.54	.58	.62	.66	.69	.73	.76	.79	.82	.85	.88	.90	.93	.95
12½	12.49	.32	.45	.55	.59	.63	.67	.71	.74	.77	.81	.84	.87	.89	.92	.95	.97
13	12.99	.32	.46	.56	.60	.65	.68	.72	.76	.79	.82	.85	.88	.91	.94	.97	.99
13½	13.49	.33	.46	.57	.61	.66	.70	.73	.77	.80	.84	.87	.90	.93	.96	.99	1.01
14	13.99	.34	.47	.58	.63	.67	.71	.75	.78	.82	.85	.89	.92	.95	.98	1.00	1.03
14½	14.49	.34	.48	.59	.64	.68	.72	.76	.80	.83	.87	.90	.93	.96	.99	1.02	1.05
15	14.99	.35	.49	.60	.65	.69	.74	.77	.81	.85	.88	.92	.95	.98	1.01	1.04	1.07
15½	15.49	.35	.50	.61	.66	.70	.75	.79	.83	.86	.90	.93	.96	1.00	1.03	1.06	1.08
16	15.99	.36	.51	.62	.67	.72	.76	.80	.84	.88	.91	.95	.98	1.01	1.04	1.07	1.10
16½	16.49	.36	.51	.63	.68	.73	.77	.81	.85	.89	.93	.96	.99	1.03	1.06	1.09	1.12
17	16.99	.37	.52	.64	.69	.74	.78	.82	.86	.90	.94	.98	1.01	1.04	1.07	1.11	1.14
17½	17.49	.37	.53	.65	.70	.75	.79	.84	.88	.92	.95	.99	1.02	1.06	1.09	1.12	1.15
18	17.99	.38	.54	.66	.71	.76	.80	.85	.89	.93	.97	1.00	1.04	1.07	1.11	1.14	1.17
18½	18.49	.38	.54	.67	.72	.77	.82	.86	.90	.94	.98	1.02	1.05	1.09	1.12	1.15	1.19
19	18.99	.39	.55	.68	.73	.78	.83	.87	.91	.96	.99	1.03	1.07	1.10	1.14	1.17	1.20
19½	19.49	.39	.56	.68	.74	.79	.84	.88	.93	.97	1.01	1.04	1.08	1.12	1.16	1.18	1.22
20	19.99	.40	.57	.69	.75	.80	.85	.89	.94	.98	1.02	1.06	1.10	1.13	1.17	1.20	1.23

Ideas FROM PRACTICAL MEN

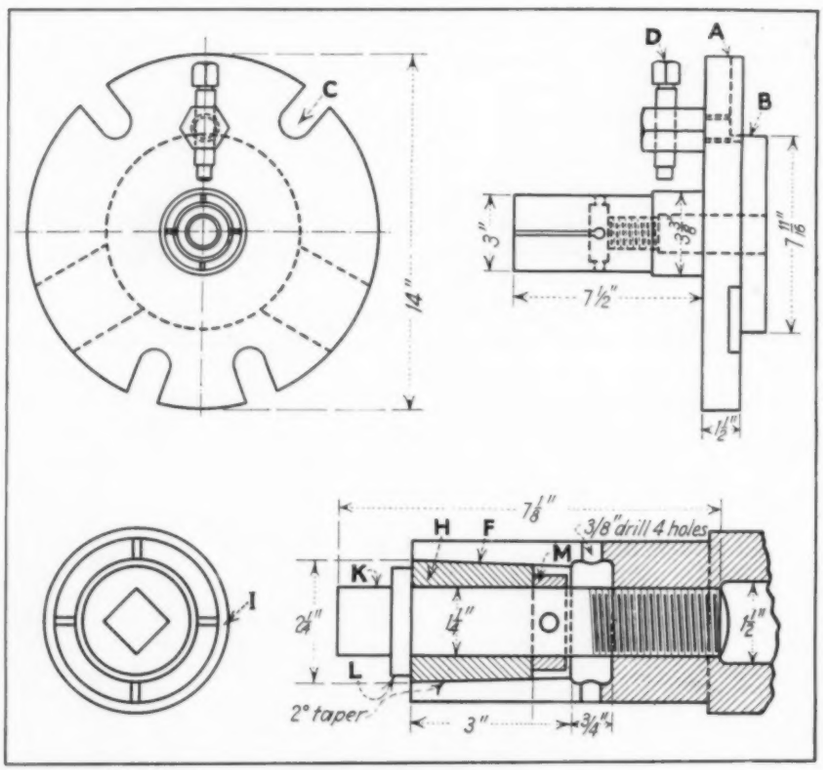
An Expansion Mandrel

CHARLES C. TOMNEY
Chief Tool Designer
Carrier Engineering Corporation

We use the expansion mandrel illustrated for holding compressor cylinders for machining the flange ends. The mandrel is made of cast iron and is mounted on the lathe chuck by its large flange. The flange is cored at *A* to clear the seats of the chuck jaws, which project about ¼-in. above the face of the chuck. The chuck jaws are, of course, removed. The mandrel is centered by the pilot *B*, which is a close fit in the central hole in the chuck. The four slots *C* are for the bolts for attaching the flange to the chuck and the setscrew *D* is for driving the work.

The body of the mandrel is a bored taper at *F* for the hollow tapered plug *H* and is slit in four places at *I* to permit it to spring in expanding and collapsing. It is expanded by tightening the square-head screw *K*, which is shouldered at *L* and is a loose fit in the taper plug. In releasing the work by loosening the screw *K*, the collar *M*, pinned to the screw, draws back the taper plug and permits the mandrel to collapse.

One of the features of this device is that it is not necessary for the operator to leave his position to tighten or loosen the mandrel in the work, as would be necessary if a draw-in rod were used.



The expanding mandrel is mounted by its flange on the face of the lathe chuck and is centered by a pilot fitting the central hole in the chuck

Fastening Drawing Paper

JOSEPH A. BAY

Referring to Bert Wallace's suggestion of using a Bostich stapler for fastening paper to the drawing board (*AM*—Vol. 79, page 375), for the past four or five years I've been using a paper tape for that purpose.

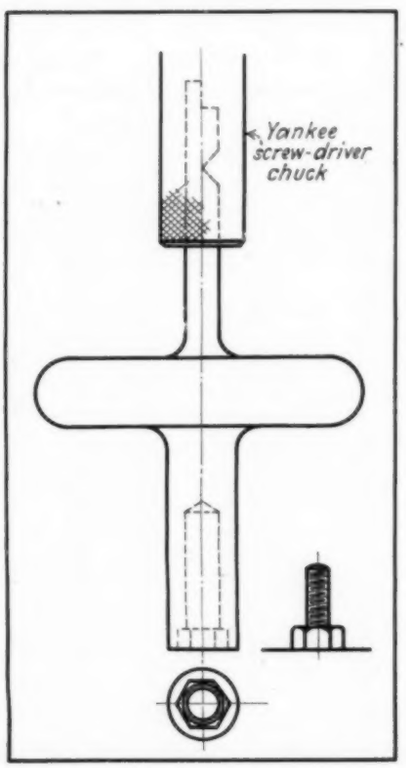
This tape, called Scotch Holdfast drafting tape, comes in rolls of 72 yards and is 1-in. wide. It has a rubber cement on one side that does not come off, and one strip can be used a great number of times. The advantage of this tape over any other means for fastening the paper to the board is that no holes are made in the board and there are no torn drawings caused by drafting instruments catching on the edges of the paper. Furthermore, the edges do not curl up.

Socket Wrench With a Balance Wheel

J. H. HENRY

We had a condition where it was necessary to use large quantities of small screws in which the threaded ends projected considerably beyond the work, making it necessary to screw down the nuts about ¾ in. To do this with an ordinary wrench slowed down the operation too much.

To speed up production, we made a socket wrench having a balance wheel, as shown in the illustration, to fit a



Nuts are screwed home by the momentum of the balance wheel at one stroke of a Yankee screwdriver

Yankee screwdriver. The momentum of the balance wheel caused by one stroke of the screwdriver ran the nuts home, and the next stroke tightened them.

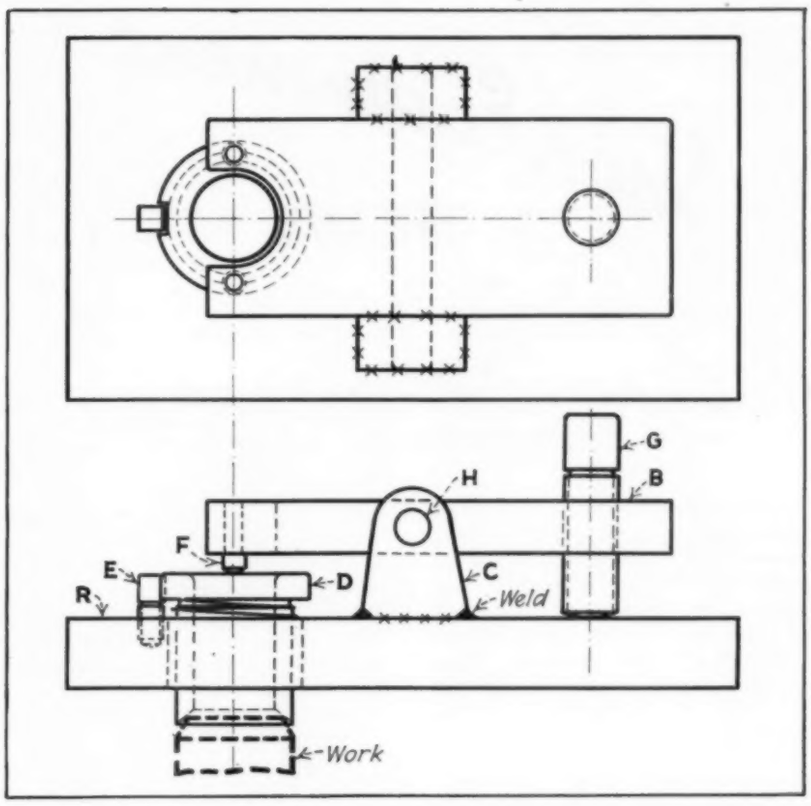
We used several of these wrenches in assembling our switches and found that the girl operators could get the nuts tighter than before. According to time-study figures the use of these wrenches saved us a little over $900 a year.

In Place of a Threaded Bushing

SIGFRIED KARNITZ
Tool Designer, Allis Chalmers Mfg. Company

The sketch shows an inexpensive and efficient clamping device. *R* represents the drill plate of the jig, *D* is a standard drill bushing with a 45-deg. ground taper for clamping the work, and screw *E* prevents the bushing from turning while drilling. Screw *G* swings the lever *B* about pin *H*, and the hardened pins *F* push down the drill bushing which is a slip fit in the liner bushing.

After the work is drilled the screw *G* is released, and the spring under the bushing head brings it back to its former position. If the work is finished and held within close limits a cam will be preferable to a screw, as it can be operated with greater rapidity.



While threaded bushings are used every day they are expensive; cast iron dust and chips wear out the threads in a short time

Accurate Cylinders for Testing Squares

J. T. TOWLSON
London, England

The following is an impartial criticism of the suggestion for testing squares contributed by A. F. Parker (*AM*—Vol. 79, page 498).

As regards the use of a piston pin no objection is called for, although it is suggested as far more practical to use a cylinder having a larger base. But when it is suggested that a square can be accurately tested against a cylinder without other provisions, I can not conceive how it is possible that Mr. Parker is serious. The square must be located accurately at a right angle laterally, otherwise, even with a true square, light will show between the blade and the cylinder.

Obviously, the square to be tested could be set up square laterally if another square were used for the purpose, but if such a square is available and is true, then the need for the cylindrical test may be ruled out at once.

The only way to use a cylinder for such a purpose, and the way it is generally used in British toolrooms, is to grind an appreciable flat along the whole length of the cylinder, and if that is done, a true square, although not quite square laterally, will shut out the light between the blade and the flat.

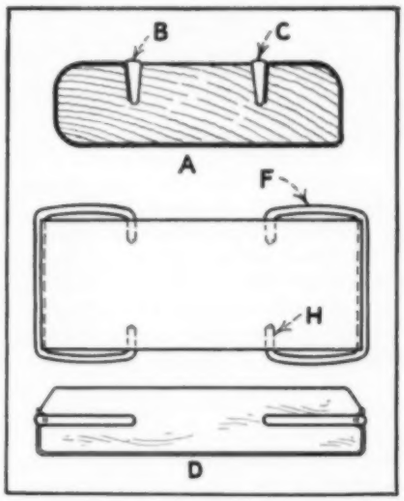
Blocks for Holding Abrasive Cloth

JOHN A. HONEGGER

Blocks for holding abrasive cloth for polishing are always in demand in the average shop. Generally anything from a piece of 2x4 scantling to a slat from a crate is used for the purpose.

Two types of blocks that the writer has found convenient are illustrated. Block *A* is a piece of maple in which the wedge-shaped grooves *B* and *C* are cut. A strip of abrasive cloth is wrapped around the block and the ends are tucked into the grooves. Then rubber wedges, cut from an eraser, are forced into the grooves and hold the abrasive cloth tightly.

Block *D* is also made of maple and is for holding longer and wider pieces of abrasive cloth. It is grooved at the ends to receive the wires *F*. The wires are bent as shown and the ends pivot in the holes *H* in the sides of the block. With the wires raised, the abrasive cloth is wrapped around the block and under the wires, after which the wires are pushed down and pinch the abrasive cloth into the grooves.



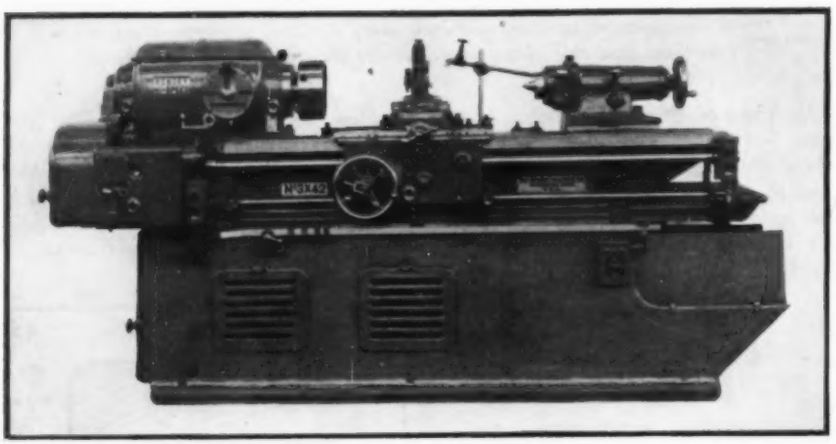
These blocks are for holding abrasive cloth. One holds it by tucking the ends into wedge-shaped grooves and driving in rubber wedges; the other by holding the ends in grooves by wire bails

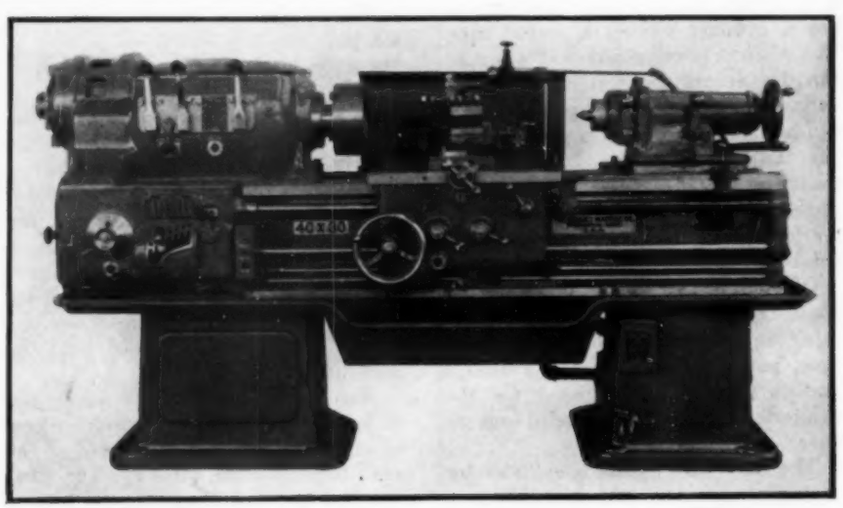
Shop Equipment NEWS

Hendey Step-Turning and Manufacturing Lathes

Designed for production turning at highest effective speeds, using the most efficient cutting tools known to the industry, the No. 3 "Hi-Speed" step-turning lathe, announced by the Hendey Machine Co., Torrington, Conn., is powered by a New Departure Transitorq coupled to an electric motor of 5 to 10 hp. Power transmission to the spindle is through a multiple V-belt drive with belt tension taken care of through hinged motor plate. Variable speed unit is operated through a flexible shaft having a handwheel and a dial giving spindle speed readings, and mounted at the end of the feed box below the headstock.

The head may be backgeared for the slower speeds needed for work of large diameters, but the spindle has ample power from the direct drive for all small work. The three-speed feed box gives two ranges: fine range, 0.001, 0.002 and 0.004 in.; coarse range, 0.0125, 0.025 and 0.050 in. Five-section multiple dials provided for the feed screw allow repeated settings of the tool for different diameters.





Above—No. 3 "Hi-Speed" step turning lathe swings 16½ in., admits 42 or 66 in. as required. Right—No. 4C manufacturing lathe swings 16⅞ in., admits 30 in. between centers. The apron of the No. 3 is automatically oiled, but this feature is applied to the apron, carriage and cross-slide of the No. 4C.

The lathe can be furnished with a taper attachment. Two finished flat ways at the rear of the bed allow for bolting forming attachments. The spindle is bored to take 1½-in. bar.

Electrical equipment includes magnetic starting switch, with two push-button stations, one alongside the feed box and the other at the end of the bed. Devices for controlling and indicating lubrication of the power unit are attached to either side of the end shield.

Swing over the ways is 16½ in.; swing over the carriage is 8½ in. Nose of the spindle is 2¾ in. diameter and is threaded 5 per in. Two lengths of bed are available 42 and 66 in. between centers.

A heavy-duty engine lathe for manufacturing and maintenance operations, the No. 4C has twelve spindle speeds in geometric progression, ranging from 30 to 1,200 r.p.m. Power is provided by a 5-hp. constant-speed, reversing-type motor, flange bolted to the end of the headstock casting. A rotor shaft transmits motion to the power input shaft of the head through a multiple disk clutch running in oil.

The gearbox has 28 changes of thread and feed through a seven-gear cone and a primary four-speed change. This combination gives a normal thread cutting range of 2¾ to 40 threads per in. By changing the pick-off gears in the feed train two additional ratios of 1 to 2 and 2 to 1 are had, and the thread ranges become 1⅜ to 20 and 5½ to 80 per in.

Lead screw is driven from the gearbox through a positive-tooth clutch. A safety-type slip clutch drives the feed rod. When one is in engagement the other is idle. Cross and longitudinal feeds have positive clutch engagement with quick-acting lever controls.

Miller Reflectors for Mercury Vapor Lamps

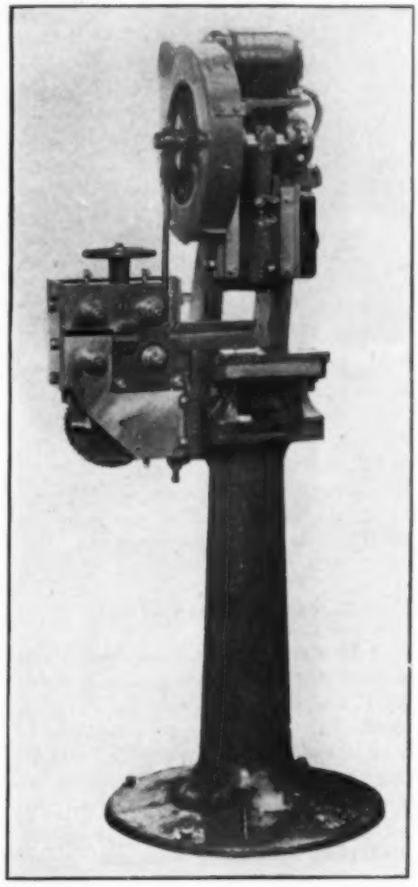
For use with mercury vapor lamps the specially designed reflectors announced by the Miller Co., Meriden, Conn., include styles and types for any type of mounting, for practically all industrial locations and for color correction of mercury-vapor illumination by individual or combination equipment.

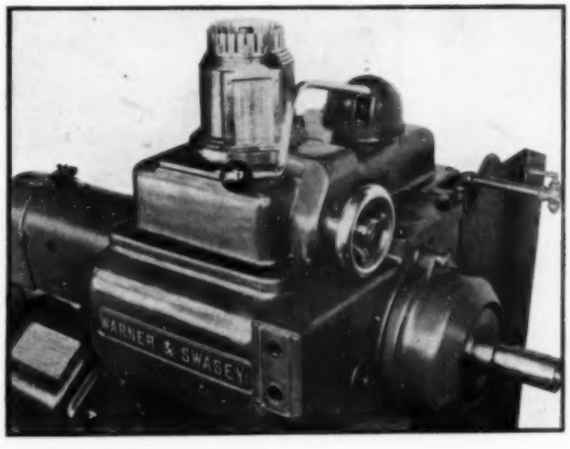
The combination reflectors permit the use of ordinary incandescent lamps along with the mercury vapor lamps in a single fixture. Lighting systems where the fixtures are alternately mercury vapor and incandescent do not provide uniform illumination in color, unless the units are mounted at sufficient heights to be well above the ordinary line of vision. This allows the incandescent and mercury vapor light to mix thoroughly before reaching working level. These Miller combination reflectors can be mounted as low as 8 ft. from the floor.

Warner & Swasey Cutting Speed Pre-Selector

The cutting-speed pre-selector announced by the Warner & Swasey Co., Cleveland, Ohio, requires but one lever for operation and enables the operator to choose the proper cutting speed and feed per minute for the next cut by the simple rotation of a handwheel. The full range of work diameters is arranged on the left- and right-hand sides of the window; the drum which rotates inside the housing indicates the proper feet per minute for each diameter in twelve vertical columns corresponding to the twelve speeds of the headstock. Selection of the proper cutting speeds requires merely rotating the drum until the proper feet per minute appear opposite the diameter to be machined. This operation sets the proper control for speed automatically. As soon as the previous cut on the work piece has been finished, the operator can then shift the machine to the proper speed required for the next cut by pulling the single lever of the headstock. Formerly, the operator was required to shift three levers, and this was not always done in order to run the job at the most productive speed.

A speed sequence indicator is incorporated in the form of a castellated drum on top of the device into the slots of which numerals are inserted to indicate the several speeds required on the job consecutively. After a job has been set up, it is no longer necessary to set the indicator drum for each speed required. The operator merely rotates the handwheel until No. 1 is in front, pulls the lever, and then while the machine is in operation brings No. 2 forward. When the machine is finished with cut No. 1, he pulls the lever and thereby has the machine ready for cut No. 2. As many speeds as can ideally be used on a job will be employed by the operator without hesitation because he simply has to set the machine from one number to the next for each shift.





A special roll feed at the left of the bolster is actuated by an adjustable bellcrank connected to the flywheel shaft. Feed variation, 0 to 1 in.

A single lever shift and a speed sequence indicator enables the operator of a machine equipped with the pre-selector unit to put more pieces on the floor

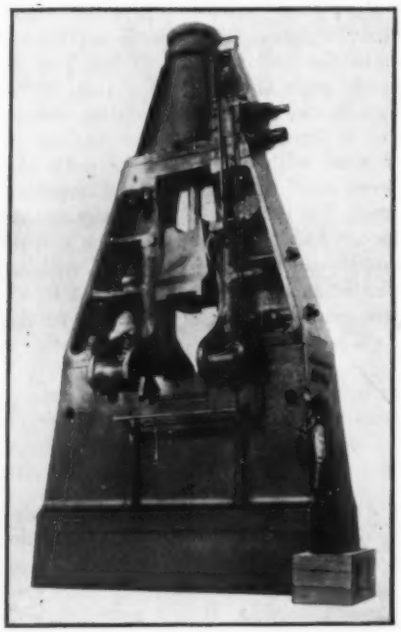
Bliss Automatic High-Production Press

One of the smallest power machines built by the E. W. Bliss Co., Toledo, Ohio, this automatic high-production press is mounted on a pedestal of convenient height. It is a complete self-contained unit direct-geared to a ½-hp. motor which drives the flywheel at a speed of 700 r.p.m. The automatic feature is obtained by a special type of roll feed mounted on the left end of the bolster, which has been especially designed to receive it. The feeding mechanism of the rolls is actuated by a bellcrank on the flywheel end of the shaft. The bellcrank has a screw adjustment that gives a variation in the feed from 0 to 1 in. A handwheel for positive adjustment of the tandem roller mechanism is provided. The feed rolls, not shown, are attached to the four studs on the side of the feed.

Duro-Brace Texsteel Sheaves

Additional stock sizes have been added to the line of "Duro-Brace" Texsteel sheaves (*AM*—Vol. 74, Page 851), manufactured by Allis-Chalmers Mfg. Co., Milwaukee, Wis. It is now possible to obtain these drives up to 15 hp. Grooves of the entire line are so designed that they can be used with A-section belts, ½x½ in., or with B-section belts, ⅝x⅞ in., depending on the application. Diameters of sheaves now range from 3 to 18 in. inclusive, for any number of grooves from two to six. All of these sheaves are now available with interchangeable-type hubs which are carried in stock with bores in ⅛ in. increments from ½ in. up to the maximum bore.

Chambersburg Model "E" Steam Drop Hammer



To attain correct impact velocity and quick pick-up on the Model "E" Steam Drop Hammer, developed by the Chambersburg Engineering Co., Chambersburg, Pa., an improved cylinder and valve were designed. The valve is a balanced slide valve with steam or air inside the valve, and fluid passages so proportioned that correct speeds are attained without "wire drawing" steam or air. This principle of design secures higher mean effective pressures in the cylinder, making possible a reduction in cylinder bore, a shorter idling stroke, and the elimination of valve leakage.

Accuracy is obtained by rigidity in the members guiding the ram with relation to the anvil. "Dancing" of the frame is avoided, as well as suction of scale between joints, by the breather holes. These holes reduce wear and thus preserve alignment by releasing the air between the anvil and the frame joints when the ram hits. The base of the frame lips the anvil to form guides on both sides of a thrust shoulder. This construction resists twisting which is particularly important in long forgings or where the final impression is slightly off-center in the die. A tie plate holds the frames in alignment and, by means of laminated steel cushions holding air and grease between laminations, relieves the shock of each blow without permitting a detectable movement in the frames. Inserted guides are fully supported on five sides in the frame.

Wear can be taken up between the frame and the anvil, and the frame and the tie plate, without disturbing any major part. Wear at the frame joints is reduced by large abutting surfaces. Realignment is facilitated by the renewable wearing plates built into all thrust bearing surfaces. Ram life is prolonged due to the ram bushings discouraging rod drive or off-center rod creep. A safety cylinder cover provides a live cushion above the piston in case the rod breaks or is pulled out of the ram. Springs and rods are eliminated, and minimum steam is used, since the steam cushion is filled from the line and is not subject to the pumping action of the hammer. A one-piece cam saves steam by eliminating lost motion in the valve control. Joints between assembled anvil, frames, tie plate and cylinder are lubricated with grease through pressure connections.

Cecolloy, a nickel-molybdenum, air-furnace iron alloy, is used for the cylinder of the Model "E," because of its strength and wear-resisting properties. This material in the annealed condition is used for the valve.

R & L Turning Tool

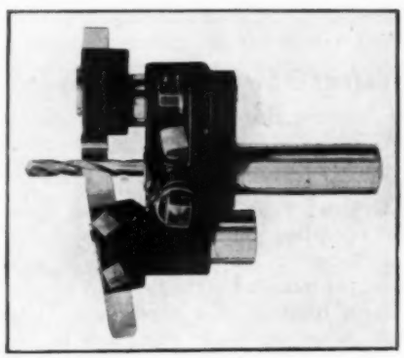
A turning tool which can be used in a variety of ways is being manufactured by R and L Tools, Nicetown, Philadelphia, Pa. This tool uses toolbits of standard size and the method of mounting them provides longer life since the bits are ground only on the top side or end. Because of the shape of the tool, less cross-slide clearance is required, permitting work to be done with cross-slide tools while the piece is being turned. It may be used for roughing and finishing cuts, either right or left hand, and can be changed from right to left hand in ten seconds.

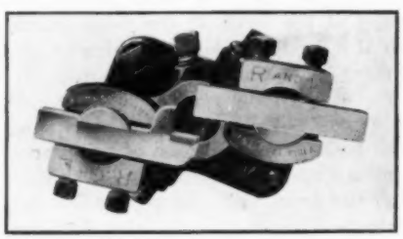
As shown in the top illustration, drilling is readily accomplished at the same time the piece is being turned, or the piece is centered while turning to provide concentricity. The floating construction allows the drill to be centered accurately. The back end of the shank is fitted with a screw plug to prevent the drill from pushing through.

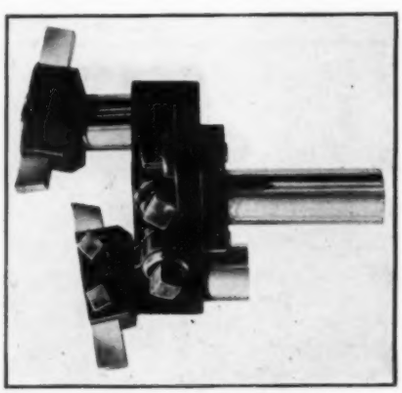
The center illustration shows the tool equipped with a bit for right-hand turning and a back rest or burnisher. The burnisher is made of tantalum carbide and will not pick up metal and mar the surface with scratches or blisters. Fine adjustment is provided on both the tool and the pressure of the burnisher.

By replacing the burnisher with extra toolholders furnished with each tool, the device is converted into a balanced turning tool with two cutting edges, as shown in the bottom illustration. Used mostly for roughing cuts where there is a desire to remove metal quickly, the cut is divided between two tools. The adjustment lengthwise permits two diameters to be turned to any length within its capacity.

Shanks are furnished to fit any machine, or an assortment of shanks of different length or diameter can be furnished so as to be interchangeable on any work for which the tool is needed. The No. 1 has a shank of ¾ in. by 2 in. long, a through hole of $\frac{7}{16}$ in.,







R & L Turning Tool can be used in a variety of ways and right- or left-hand

and will turn from 0 to ½ in. diameter by 2¼ in. long if not used with the drill. The drill prevents turning lengths more than 1¼ in. The No. 2 tool has a shank 1 in. in diameter by 2 in. long and the hole through is ⅝ in. in diameter. It turns from 0 to ¾ in. in diameter by 2¾ in. long if not used with the drill, and 1½ in. long if used with the drill.

Hardinge MD5 Precision Milling Machine

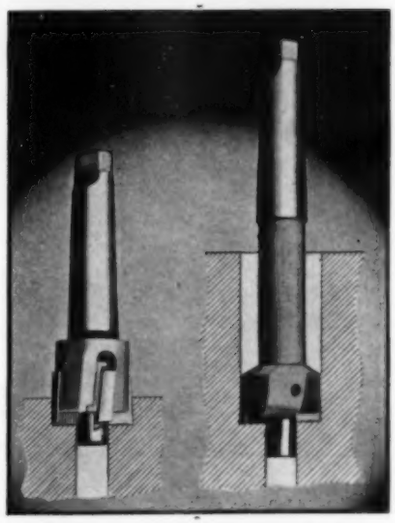
For the toolroom and laboratory, Hardinge Brothers, Inc., Elmira, N. Y., is building the MD5 precision milling machine of size as to allow for ease of operation in such work. The table is 24 in. by 6 in. and the working surface 20x6 in. Three T-slots are ⅝ in. wide. The range is 13¾ in. longitudinal, 6 in. traverse and 7 in. vertical. Distance from the center of the spindle to the table in lowest position is 7 in. The arbor is ⅞ in. in diameter, 7 in. long with spacers and nut. Six speeds forward and six speeds in reverse range from 120 to 1,190 r.p.m. Feed screws revolve in long adjustable nuts and have friction dials graduated in thousandths. The knee section is fully enclosed to exclude dirt and chips. Floor space, 45x43 in.; weight, 825 lb.

Ingersoll Zee-Lock Counterbore

The Ingersoll Milling Machine Co., Rockford, Ill., has extended the application of its "Zee-Lock" cutter blade to inserted-blade counterbores. Two designs are offered: one of the shallow type used for shallow boring or spotfacing operations, and another for deep boring operations. Serrations are broached into the cutter housing so that by moving the cutter blade to the next slot in sequence, the blade is moved out only part of a serration. Thus, the diameter is maintained with a minimum of grinding.

American Optical 6-Curve Super Armorplate Lens

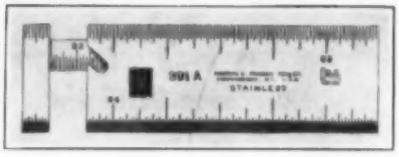
A goggle lens having far greater impact resistance than previously used in standard eye-protection equipment is being offered by the American Optical Co., Southbridge, Mass. This lens, called the "6-Curve Super Armorplate," obtains extra strength from its high curvature. As shown, a 1-inch solid steel ball was dropped on the lens from a height of 10 ft., which is three times the government standard test, and the weight was four times the standard test amount. The curvature besides giving greater strength permits a closer fitting to the face without interfering with the eyelashes. Should the lens be shattered, the curvature tends to cause the fragments to move away from the eye.



Photograph of 6-Curve lens at the moment of impact by test ball

Brown & Sharpe Stainless Caliper Rule

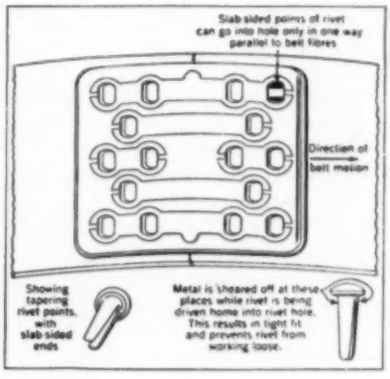
The Brown & Sharpe Manufacturing Co., Providence, R. I., has announced caliper rule No. 391A, made of stainless steel. This rule is made only in 3 in. lengths and is graduated as follows: first corner in 8ths; second corner in 16ths; third corner in 32ds; fourth corner in 64ths. The slide is graduated in 32ds and 64ths.



Bristol Belt Plate

Design of the holes in the belt plate, announced by the Bristol Co., Waterbury, Conn., makes it impossible to insert the rivet into the belt except in one position. In this position the rivet points cut through the belt, making a slot that runs lengthwise with the belt. This method of inserting the rivet does not impair the lengthwise fibers of the belt, and therefore, does not cut down the strength of the belt or the effective cross-sectional area.

Metal is sheared off the rivets by the flat portions of the hole while the rivet is being driven home. This results in a tight fit and prevents the rivet from working loose.

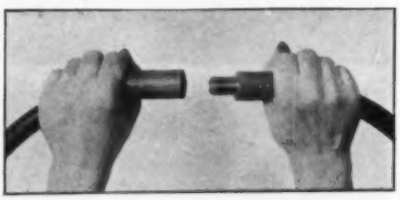

Slab-sided points of rivet can go into hole only in one way parallel to belt fibres
Direction of belt motion
Showing tapering rivet points with slab-sided ends
Metal is sheared off at these places while rivet is being driven home into rivet hole. This results in tight fit and prevents rivet from working loose.

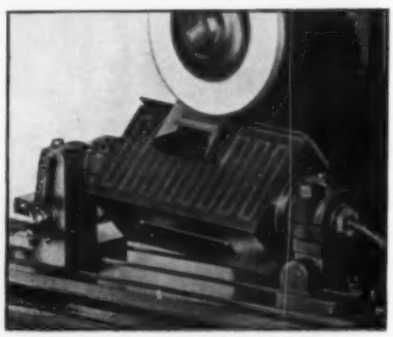
South Bend 9-In. Precision Lathe

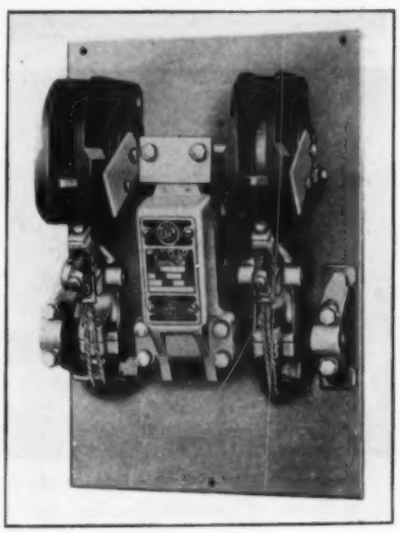
A 1936 Model 9-in. back-geared lathe has been developed by the South Bend Lathe Works, South Bend, Ind., for small-piece production jobs, tool-making, instrument making and all classes of accurate work. Ten improvements are incorporated. Among these are the twin gear reverse for right- and left-hand screw threads and automatic longitudinal feeds to carriage, ball thrust bearing for the headstock spindle, and improved tailstock, an improved compound rest, a heavier saddle, and simplified gearing for threads and speeds. Eight different models are available, six bench and two floor leg, supplied in bed lengths of 3 ft., 3½ ft., 4 ft., and 4½ ft. Six spindle speeds are 39 to 630 r.p.m., and the screw cutting range is 4 to 40 per in. Manufacturing and general machine shop attachments can be applied.

E.C. & M. 100-300 Amp. Built-in Contactors

Type LTZ "Line-Arc" contactors in 100-, 150- and 300-amp. sizes for built-in use have been announced by the Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio. They are of aluminum-alloy construction for high-speed operation. The contactors are built in single-, double- and triple-pole types and are arranged for terminal connections either at the front or rear of the contactor base.







Carboloy Wheel Dresser

The Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit, Mich., has announced an additional grade of its diamond impregnated wheel dresser. This grade contains an extra-coarse mesh of diamonds and has been developed to increase the order of performance on the larger and harder grades of grinding wheels used on surface, cylindrical and centerless grinders. No remountings of the diamonds are necessary in this tool.

Lincoln Quick-Detachable Welding Cable Connector

The Lincoln Electric Co., Cleveland, Ohio, is marketing a quick-detachable connector designed for use in connecting welding or electrode cable and which locks in position and cannot work loose or be accidentally pulled apart. The plug is inserted in the jack and a twist of the wrist locks the connection. Protection against grounding is assured by fibre insulating sleeves.

Taft-Peirce Precision Duplex Magnetic Chuck

A tilting and swiveling magnetic chuck known as the "Super-Power Precision Duplex Base," designed for the precision grinding of compound angles, has been announced by the Taft-Peirce Manufacturing Co., Woonsocket, R. I. Besides being of use for grinding form tools, the device offers advantages of time saving and increased accuracy in the grinding of compound angles of any nature and also in producing work requiring the grinding of simple angles. The magnetic unit of this chuck swivels 90 deg. on either side of horizontal and can be tilted along its axis to any angle from 0 to 14 deg. Two simple adjustments take the place of long and complicated set-ups.

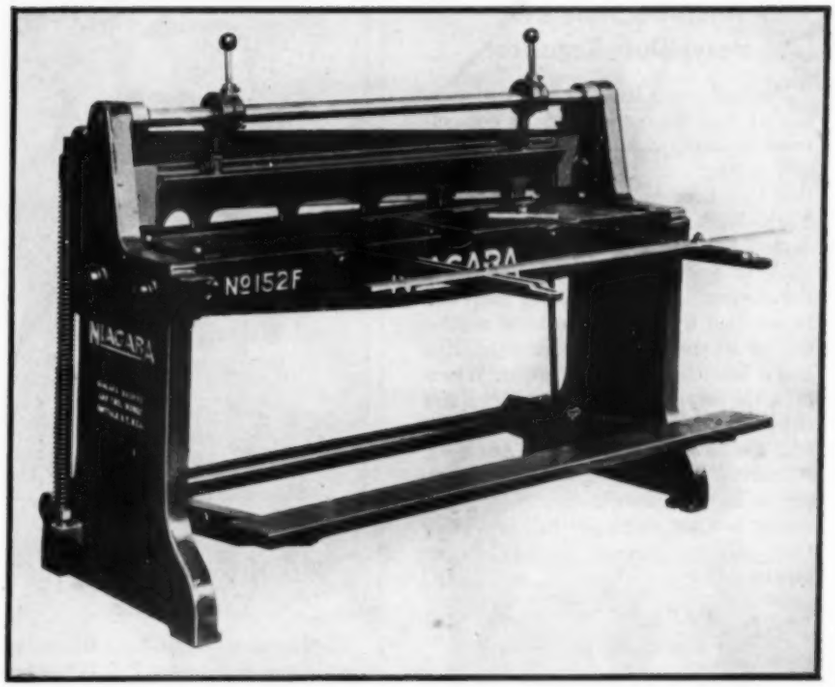
Niagara Series F Foot-Operated Shears

For cutting up to 16-gage metal, the Niagara Machine & Tool Works, Buffalo, N. Y., is offering the Series F foot-operated squaring shears. A feature is the steel holddown which is operated manually by self-locking eccentrics and exerts heavy pressure on the sheet to maintain accuracy of shearing throughout the entire length of the cut. The holddown is designed to provide visibility for shearing to a line.

The steel crosshead provides rigid backing for the knife, resulting in smooth accurate cutting, and the long counterbalancing springs also contribute to easy operation.

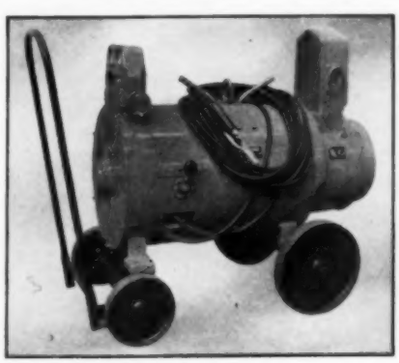
On the 96- and the 120-in. length shears, a parallel-screw adjustable back gage is furnished. This gage is readily adjusted from either side of the machine and maintains parallel alignment with the knives throughout the entire range. The treadle mechanism now has a large tubular cross-member which resists torsion or twist, thus assuring equal motion of both ends of the crosshead, regardless of where the operator applies pressure to the treadle.

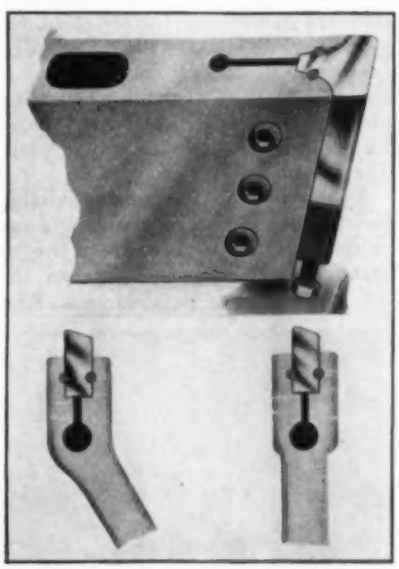
Series F shears are completely equipped with Niagara shear knives, back gage, front gage, side gages and bevel gage. They are available in cutting lengths from 36 to 72 in. for 16 gage. Foot operated shears in 8 ft. and 10 ft. cutting lengths are also available for 18 gage.



P & H-Hansen Heavy-Duty Welder

The Harnischfeger Corp., Milwaukee, Wis., is building 200-, 300- and 400-amp. "P&H-Hansen" heavy-duty arc welders of improved design. The machines now have oversize two-bearing armature shaft, removable bearing cartridges, single-current control, dustproof calibration plate, heavy-duty and built-in polarity switch.





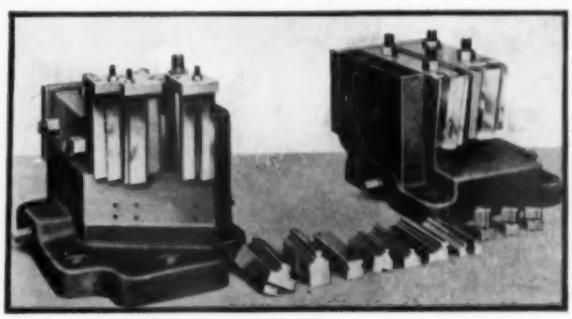
Above is a pin-splice forming tool illustrating the manner in which the filler blocks are used to repiace portions of the tool worn out in service, while below is shown the application of a pin splice to lathe tools

"Mitco" Pin-Splice Tools

The Michigan Tool Co., Detroit, Mich., has announced a line of "Mitco Pin Splice" tools in which guide pins are used to locate the tool in the holder. The holder and the tool are provided with small diameter semicylindrical grooves which are parallel to a line tangent to the work piece at the point of tool contact. Dowel or splice pins fit into these grooves and are fixed in the holder. The tool can can be shifted up or down in the holder to the correct position, using the pins as guides. When in the correct position, the tool is locked in place by tightening the clamps of the split holder.

Re-grinding is simplified in that the tool is ground down to a new cutting edge and shifted up slightly in the holder, in proportion to the amount of stock removed. No angular adjustment is necessary.

For circular form turning, the new tools provide a degree of support under the cutting edge not usually found.



A complete pin splice tooling set-up for an automatic lathe for rough and finish turning, cheeking and forming, of a rear crankshaft bearing, together with the crankshaft flange

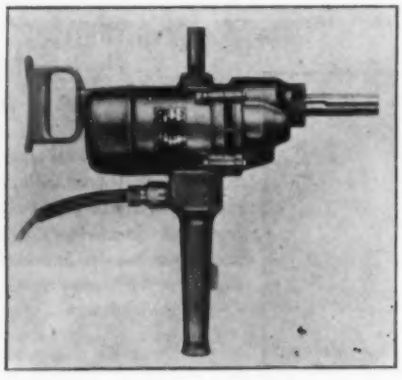
Airco-DB Style 8490 Heavy-Duty Regulator

For delivering large volumes of oxygen at high pressures such as encountered in heavy cutting, deseaming jobs and similar operations, the Air Reduction Co., Lincoln Bldg., 42nd St., New York, N. Y., is offering the Airco-DB Style 8490, two-stage reduction regulator. It finds its principal use where the oxygen demand is greater than can be handled by the conventional regulator, or where close pressure regulation and a low end-point are desired. Whenever the oxygen demand per regulator is in excess of 1,000 to 1,200 cu.ft. per hr., the 8490 type should be used. Maximum operating pressure is 200 lb. per sq.in. and maximum delivery capacity is 3,000 cu.ft. per hr., providing the delivery pressure is 100 lb. or greater.

CP Universal Electric Drills

The Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y., is now offering a line of universal electric drills made in the following sizes: $\frac{1}{4}$-in. heavy duty, $\frac{1}{4}$-in. standard duty, $\frac{1}{4}$-in. heavy duty, $\frac{3}{8}$-in. heavy duty, $\frac{3}{8}$-in. standard duty, $\frac{3}{8}$-in. heavy duty, $\frac{1}{2}$-in. standard duty, $\frac{1}{2}$-in. heavy duty, $\frac{3}{8}$-in. standard duty, $\frac{5}{8}$-in. heavy duty, $\frac{7}{8}$-in. heavy duty and 1-in. heavy duty. Typical features of the universal heavy-duty, side-handle drills and pistol-grip drills are a high-torque, high-powered motor, helical armature gearing, double sealed armature bearings, a safety-type trigger with switch lock for optional use, a removable cable disconnector furnished as an extra, three-conductor cables providing a safety ground wire. On the side-handle drills the combination handle can be turned 90 deg. or removed entirely.

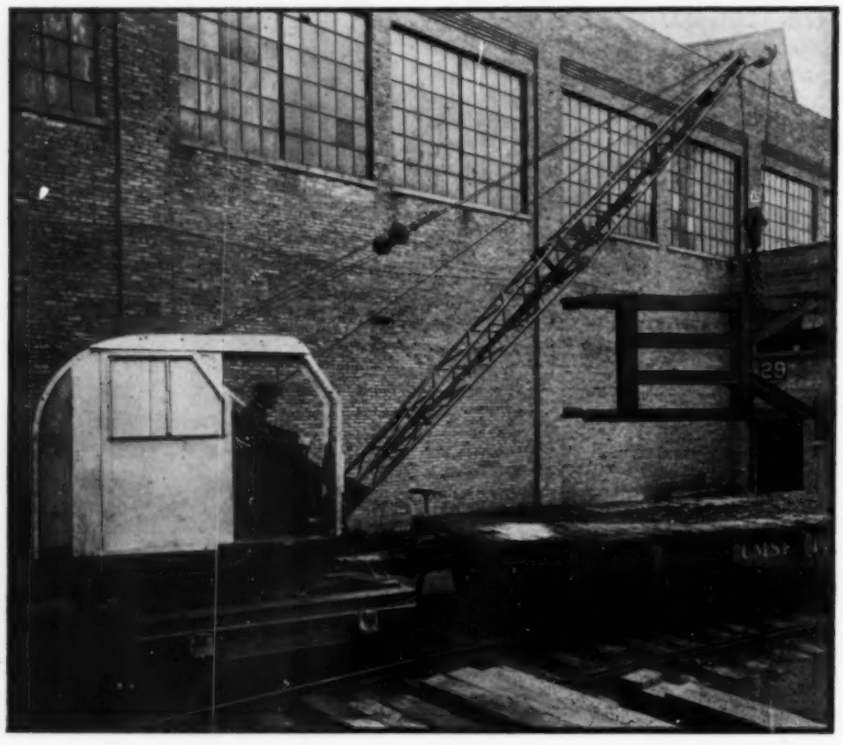
CP No. 985 1-in. heavy-duty drill



P & H Bantam-Weight Yard Crane

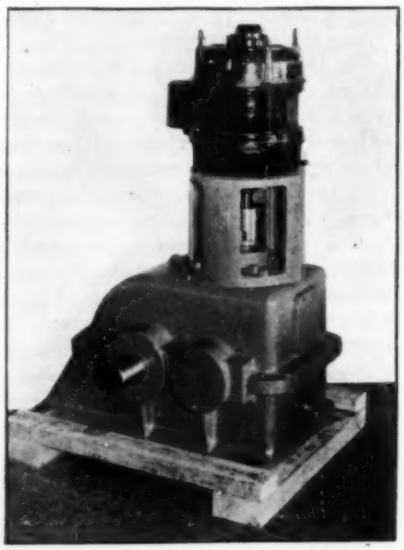
The Harnischfeger Corp., Milwaukee, Wis., is now building a P & H bantam-weight crane which is self-propelling on standard rail wheels and designed for spur handling of materials. The 25-ft. boom will lift 7,730 lb. at 10-ft. radius an 2,360 lb. at 25-ft. radius. The crane exerts a drawbar pull of 3,150 lb. and travels at speeds from 1.8 to 6.5 m.p.h. The weight is 21,000 lb.

As shown below the crane is suitable for spur handling of materials and car switching. It will move from two to seven freight cars, depending on the loading. Power is supplied by a Ford V-8 motor. The standard-gage truck mounting has a wheelbase of 5 ft. 6 in. and an over-all length of 8 ft. 5½ in.



James Speed Reducer

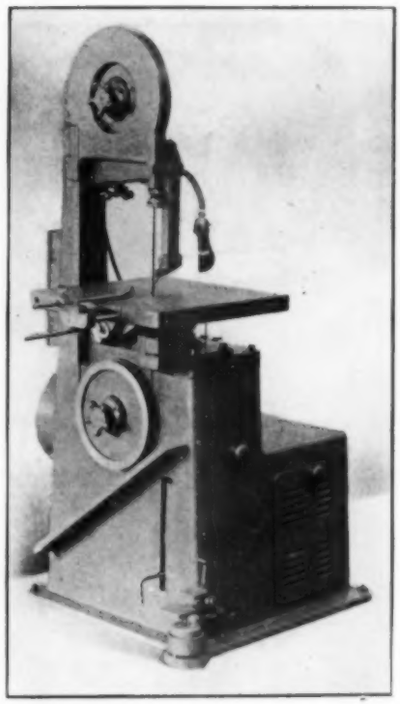
The D. O. James Mfg. Co., 1114 W. Monroe St., Chicago, Ill., is producing a horizontal speed reducer consisting of a combination of spiral bevel gears and continuous tooth herringbone gears with a motor mounted on top. The drive occupies a minimum of floor space and is made in a range of horsepowers from 1 to 200, and ratios from 8 to 1 to 45 to 1 or higher. Timken bearings are used throughout.



N.K.&B. Precision Bandsaw with Filing Attachment

A continuous filing attachment for use in manufacturing dies is applied to the precision bandsaw now offered by Neff, Kohlbusch & Bissell, Inc., 2400 W. Madison St., Chicago, Ill. This machine is especially suitable for long narrow openings and slots. It uses saws ranging in width from $\frac{1}{8}$ to $\frac{3}{8}$ in. and in lengths varying from 9 to 10 ft. An arrangement for automatic feed of the work is incorporated.

When band filing is to be done, the upper and lower saw drums are replaced to accommodate the file chains. A file chain guide and bracket are furnished and the change-over takes approximately ten minutes. Specifications: Distance saw to column, 14 in.; size of table, 22x22 in.; tilt of table in four directions, 10 deg.; maximum thickness of material admitted, 8 in.; speed of saw, 125 ft. per min.; speed of files, 180 ft. per min.



Udylite Semi-Automatic Plating Machine

Production can be regulated within very close limits in the semi-automatic plating machine developed by the Udylite Co., Detroit, Mich. The work racks are hung on a chain conveyor and are carried away from and brought to the operator at a definite rate of speed, between 1 and 4 ft. per min. Each piece is subjected to identical plating conditions; that is, plating time and current density. Features include a structural steel chassis, simplified chain-hook combination with an alloy steel chain, cut tooth drive sprockets and the application of ball and roller bearings which need lubrication but once every six months. The semi-automatic plating machine is made in a wide variety of sizes to conform to individual plating problems. The model shown is 18 ft. long.

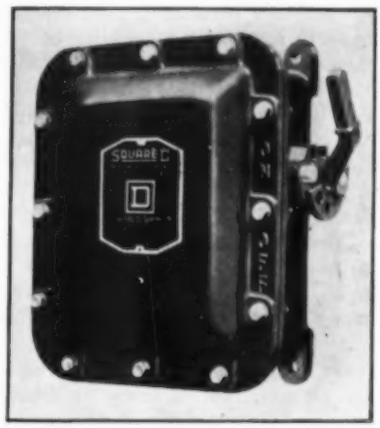
Lenney Variable-Speed Transmission

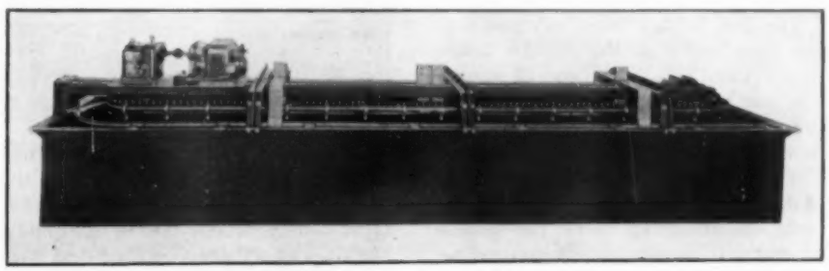
Over-running clutches are employed in the variable-speed transmission announced by the Lenney Machine & Mfg. Co., Warren, Ohio. Mounted on the input shaft are cams, which through cam yokes, connecting links and gear segments, operate the three over-running clutches. There are three cam movements actuating the three clutch driving collars with each revolution of the input shaft, thus providing a uniform and steady flow of power to the output shaft. For example, with a 1,750 r.p.m. input there are 5,250 clutch impulses per revolution of the output shaft.

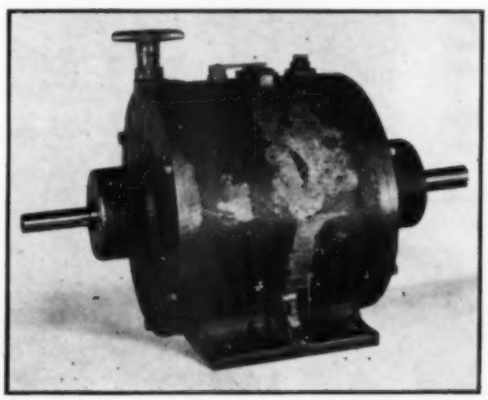
The speed is instantly adjustable to a fraction of a revolution per minute at any time by turning the speed control indicator on top of the unit. The speed of the output shaft depends upon the distance the drive and clutch collars are moved with each impulse of the input shaft cams. Increasing their travel increases the output shaft speed and decreasing the travel decreases the speed. The range of speed with a 1,200-r.p.m. motor is from 0 to 150 r.p.m., or with a 1,750-r.p.m. motor from 0 to 200 r.p.m.

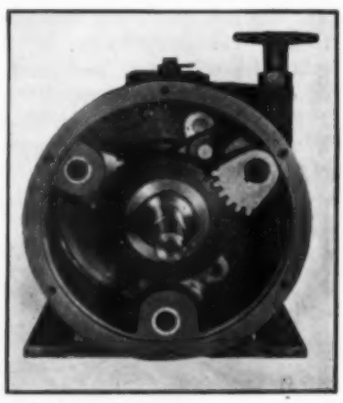
Square D Explosion-Proof Switches

Single-throw and double-throw, not fusible, explosion-proof switches have been announced by the Switch and Panel Division, Square D Co., Detroit, Mich. Two pipe-threaded conduit holes are supplied at the bottom, and pads on the sides and at the top are for drilling other holes. The switches









At the right the Lenney unit is shown with case removed from the output end

are of heavy-duty industrial type. Obtainable in two and three poles from 30 to 200 amp., 575 volts a.c. and 600 volts d.c.

Millholland No. 3 Automatic Drilling Unit

A number of improvements have been made in the No. 3 automatic drilling unit by the Millholland Sales & Machine Co., Indianapolis, Ind. This unit, which combines cam and hydraulic operation, has a 3-in. stroke, uses a 1- to 3-hp. motor, and has a drilling capacity up to 1⅛ in. in steel. It has the same mounting dimensions as the older models to permit replacement without disturbing bases, multiple heads or fixtures on present machines.

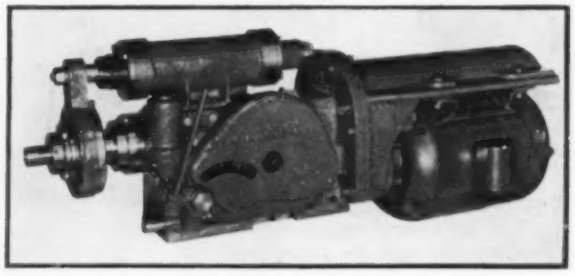
Cam feed parts have been strengthened to increase the capacity of these members, and the bronze quill bushing has been lengthened to give greater rigidity to the spindle. In addition, the spindle quill has overhead support from the return cylinder piston rod, which is piloted in the front and back bushings of the return cylinder.

The return cylinder is now arranged to use hydraulic pressure of 75 lb. per sq.in., provided by a motor-driven pumping unit and storage tank. Without change in the unit, the return cylinder may be used with air pressure, the air consumption being low because the air is not exhausted but compressed back in the line.

The No. 3 unit takes any make of foot-type motor in the NEMA frame sizes 224 and 225. Two types of mountings are available, one for 1:4 reduction from motor speed and the other down to 1:16 through back gearing. The unit has high speed capacity up to 3,000 r.p.m. Cam operation permits cycle operations up to 60 per minute or down to one minute or more per cycle. Cam contour can be made to suit the job. Cam and feed gears are readily changed, being in pick-off position protected by cast iron covers on either side of the body.

The unit can be mounted either horizontally or vertically or at any angle.

A flanged quill for mounting multiple heads is standard equipment on the No. 3 unit, but No. 2 or No. 3 Morse taper can be supplied for single-spindle work. The unit can be furnished with the milling head for sawing, face, end or straddle milling.



Millholland No. 3 automatic drilling unit which drills to 1⅛ in. in steel

Youngstown Safety Limit Stop

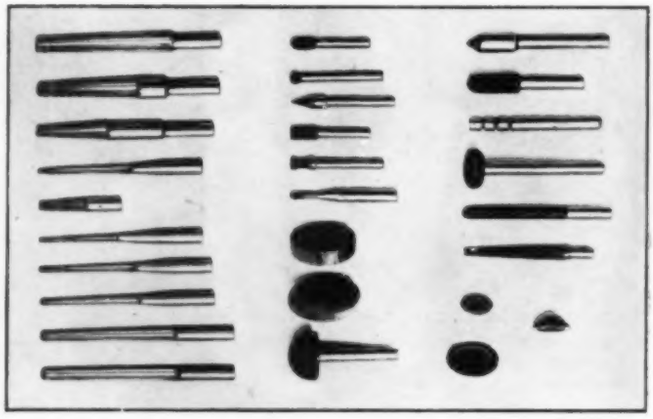
For use as a safety device in preventing over-hoisting accidents on overhead traveling cranes and other applications, the Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland, Ohio, is building an improved Youngstown safety limit stop. This limit stop is of the main-motor circuit type, handling motor currents directly without the aid of additional equipment. When the limit stop is tripped, it not only disconnects the motor from the power line but it also brings the motor to rest quickly with minimum drift.

Chicago Model C Elbow Machine

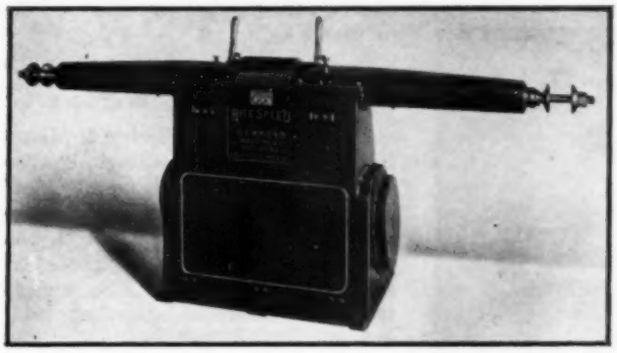
From 500 to 1,000 elbows can be made in an 8-hr. day from finished smokepipe on the Model C elbow machine offered by Ingels Elbow Machine Corp., 2634 Fullerton Ave., Chicago, Ill. Two men have room to operate the machine, but one man can work at it. The machine will work on smokepipe elbows in 22 gage and lighter. The elbows are airtight under pressure at the bead seams.

Rotary Hand Cut and Mill Cut Files

High-carbon and high-speed steel, hand-cut and mill-cut files are being offered in an increased range of sizes and shapes by the Rotary File Co., Stratford, Conn. The accompanying illustration shows a group of mill-cut files at the left particularly suitable for cleaning narrow and deep recesses in aluminum, soft brass and silver. The center group and the right-hand group show various shapes of hand-cut files and wheels.



Below—Two-motor machine with 30-in. wheel clearance. Right—Spindle overhang is 8-in.



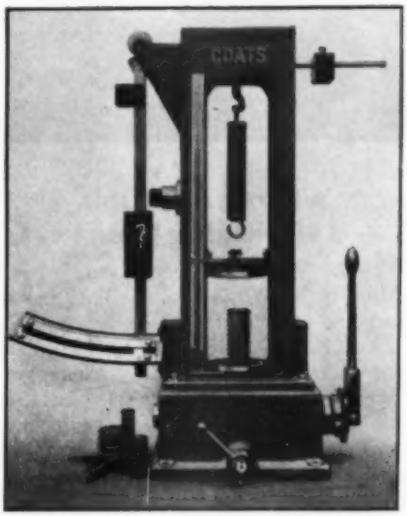
Hammond Fender Polishing Lathes

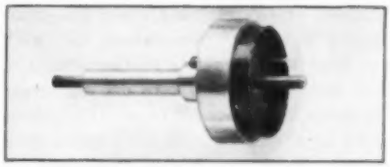
Hammond Machinery Builders, Inc., Kalamazoo, Mich., is offering two polishing lathes especially designed for automobile fender polishing and other work of a similar nature requiring wide swing machines. The model RR, two-spindle, two-motor polishing lathe has V-belt drive from the motors to the spindles. The machine is made in three sizes for 3- to 15-hp. motors. Distance from the side of the base to the inside of the wheel may be up to 30 in. The model shown has a distance of 107 in. overall.

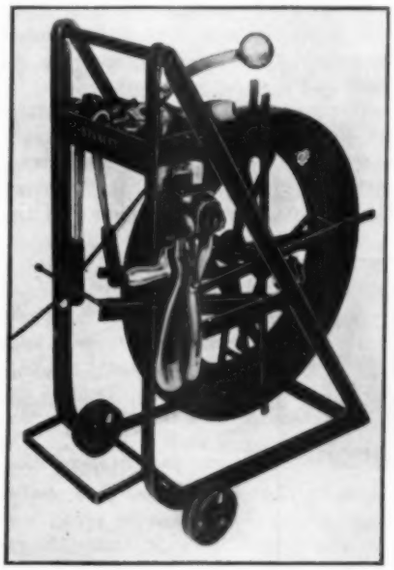
The model ROEH overhanging-spindle lathe is designed for fender polishing or other work requiring large working space around the wheels. Motors of 10, 15 or 20 hp. are mounted in the base with V-belt drive to the spindles. The spindle is mounted on four over-size ball bearings which can be removed for replacing V-belts without opening the bearing housings or disturbing the motor. The illustration shows a 15-hp. machine. The spindle has an 8-in. overhang from the front of the base and is 96 in. long overall, while the distance from the side of the base to inside of the wheel is 20 in.

Stanley Reel Stand

The Steel Strapping Division, Stanley Works, New Britain, Conn., is marketing a reel stand that eliminates the waste of steel strapping and loss of time. Only a few seconds are required to mount a coil. The reel brake is automatic in operation and positive in action. The moment the operator stops pulling the strapping through the guide, the brake arm falls and locks the reel, thus preventing backlash. This reel stand is equipped with a box for seals and has hooks on either side on which to hang the strapping tools.







Coats Type RP Spring Tester

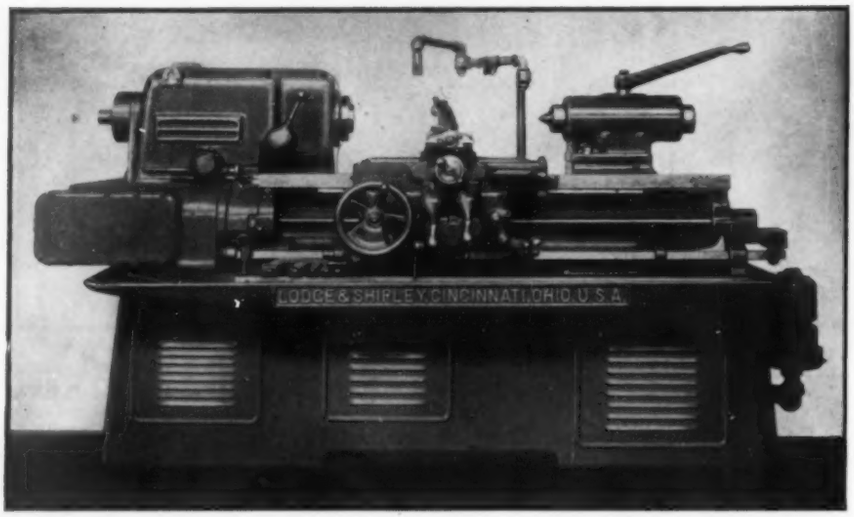
The Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y., has placed on the market the Type RP "Elasticometer" spring testing machine for loads up to 750 lb. Drive consists of two racks operated by hand lever and pinions. The stroke of the racks is governed by an automatic stop located on the drive shaft and connected with a dog-clutch. It may be set to tensioned spring length regardless of how many turns in all the shaft is required to make. This permits a rate of 600 springs per hour where length changes are not too great. The load on the main beam is always a pull, no matter whether extension or compression springs are being tested. Weak springs can be tested with the same accuracy as heavy springs.

Two models weigh to 500 and 750 lb., respectively. Distance between compression plates of small machine in either model is 23½ in., on the larger machine, 35 in. Tension hooks reduce these spaces.

Atkins Hole Saw

E. C. Atkins & Co., 402 South Illinois St., Indianapolis, Ind., is offering to the industrial trade a hole saw for cutting holes or plugs of any size from ⅞ to 4⅛ in. in diameter. The blade is replaceable in a permanent saw holder, eliminating the necessity for discarding the holder when only the blade is worn out. Spindles are made in two types: No. 2, ½ in. in diameter, and No. 3, ¼ in. in diameter, both fitting any diameter of holders and blades. The holders, or heads, are made in two sizes: No. 4 for use with a ¼-in. center drill for hole guide, No. 5 for use with drill jigs. The hole saws are equipped with alloy steel blades having fourteen teeth per inch. "Silver Steel" metal and wood cutting blades may be used in these saws.

Lodge & Shipley High-Speed Lathe



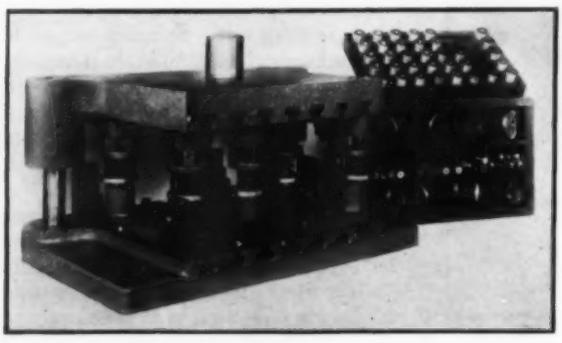
Spindle speeds infinitely variable between 400-2400 r.p.m. as the minimum, or 600-3600 r.p.m. as the maximum, are available on the high-speed lathe developed by The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. These speeds are infinitely variable because of the New Departure variable-speed unit with a 6 to 1 ratio. Four ranges of feeds may be had in the built-in apron, although only one range is furnished with the machine. No. 1 feed range is from 0.0001 to 0.0016 in., and No. 4 range from 0.004 to 0.064 in. Swing over the bed is 16½ in., over the compound rest and carriage, 10½ in., and over the compound rest and rear-connected rest, 8⅝ in. Distance between centers is 30 in. Hole through the spindle is 1⅞ in., and the taper centers are No. 4 Morse.

The headstock and feed mechanism are equipped with automatic lubrication. Pick-off gears are furnished for the feed, and multiple automatic length feed stops or single length stops can be fitted. The motor may be of 5, 7½ or 10 hp., as required. The cutting compound reservoir is of 30-gal. capacity, and the pump delivers 25 g.p.m.

Whistler Adjustable Perforating Dies

S. B. Whistler & Sons, Inc., 752-4 Military Road, Buffalo, N. Y., is now building a perforating die which is said not to become obsolete, but to be good for years of service. The company is offering a 12x12 in. working surface die set with 35 various sizes of punches and dies, gages, twenty stripping units and a case for the dies and units not in use, including five punch and die retainers. The center distance can be set as close as 1½ in. By using the company's universal perforating die with two standard punch and die retainers, and one special die retainer of larger diameter, it is possible to set these three units in about 20 min. to form a progressive perforating and blanking die for producing washers. The stripper unit is so designed that it is possible to punch up to and including ⅛ in. stock.

When a group of holes similar to a set of four or five holes used for hinges is required, the unit can be made complete as a cluster die so that in moving the unit on the T-slotted die bed the entire group of holes is constant. All parts are interchangeable and tolerances on the punches and dies are held to 0.0002 in.

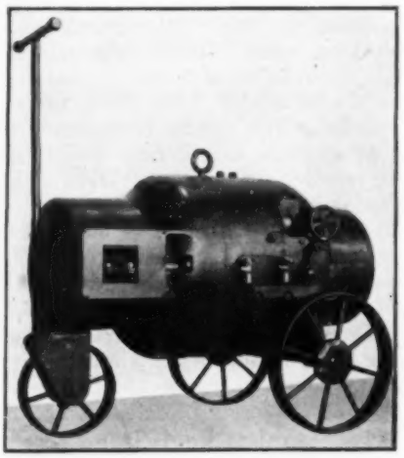


Quick set-ups without die costs are obtainable with the Whistler adjustable die set and large assortment of punches, dies, gages and strippers. Center distance can be as close as 1½ in.

"Flexarc" D.C. Welders

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has announced an improved line of "Flexarc" d.c. welders equipped with a single-dial preset control by which the welding current can be set to the exact number of amperes. The moment the arc is struck, the set adjusts itself immediately to the required preset value.

The generator has no shunt field which is responsible for the absence of the field rheostat, exciter, or external reactor. Output is adjusted by means of iron damper plates operated by a single-point "Adjustomatic" control. These plates serve as a magnetic shunt for the reaction flux of the machine, and their position with respect to the main flux path determines the welding current. Damper coils on the damper plates resist flux variation in the plates and stabilize the machine. The driving motor is of the squirrel-cage induction type. For portable mounting of the set, a three-wheel design brings the machine close to the floor and increases the stability.



Markal Paint Stick

Helmer & Staley, 2475 South Parkway, Chicago, Ill., are now marketing the "Markal" paint stick, which is paint in stick form. It is made in two types; one for cold marking and the other for hot marking. It dries and remains as permanent as any other paint and is furnished in the following colors: black, white, red, yellow and blue, and for hot marking in white and yellow. It is offered for marking machinery parts for identification.

The Round Table

PRAISE in PUBLIC

Ed had arrived at Al's office just as several of the men went out. Some looked cheerful, some a bit glum, others just looked.

"What's the trouble, Al? Strike committee or something? Kind of a mixed looking lot—some happy, some in the dumps. What's it all about anyhow?"

"Just a little meeting with some of the boys, Ed. Been talking things over with some of them about the work. Giving a little judicious praise where it will do good."

"Guess you didn't have enough to go clear around them, Al. Some of them looked as though they got panned instead."

"Wrong again, Al. I never pan a man in front of others—it's poor policy, hurts his pride and he nurses a grouch afterwards."

"But you hand out bouquets in public—if I heard you right. Why be so darn careful about the scallions?"

"It's different, Ed. If you can praise a man a little before the rest it sort of puffs him up even if he does try to laugh it off. He likes to have the other men know you think he's good."

"But how do the others feel if you don't have glad news for them too? Isn't that as bad as telling them they aren't so good?"

"I think there's quite a difference, Ed. Men don't mind the other fellow's getting a boost if it isn't a knock for them. If you don't bring up something that shows them up they feel that the other chap got a break because of the work he was doing. He expects to get his glad words the next time."

"Wouldn't it be more effective to point out shortcomings before the whole crowd? Or don't you want to hurt any feelings by mentioning them at all?"

"Sorry to say I have to criticize a bit sometimes, Ed, but I try to do it as mildly as possible. I hate it like poison. But I always go to the man personally and talk to him quietly. I warn him that we can't tolerate poor work or carelessness. Of course, we can't expect perfection, but too many mistakes mean we have to part company."

"Most men are so thick skinned that a little thing like a bawling out in public doesn't bother them a bit, Al. It's the only way to get under the skin of some men."

"I think you're wrong as to most men, Ed. There may be a few that way, but they're scarce. My motto is to praise 'em in public, pan 'em in private."

Is Al right in being considerate of his men's feelings? Or is it better to follow Ed's idea and come right out with what you think?

DISCUSSION

Five-Day Week

In no instance that I have known where concerns have adopted the five-day week have they gone back to the six-day system, and they have invariably reported that output has been maintained.

In engineering shops in this country, the time worked on Saturdays is from four to four and one-half hours, but it cannot be said that average efficiency is maintained, as there is always a certain degree of slackness on that day. In many districts, the time spent in traveling to and from work is nearly equal to the time worked on Saturdays.

When changes in working conditions are contemplated, it is always good policy to arrive at a mutual agreement, and suggestions from employees should be given consideration.

However, the unexpected happened in a works employing a large percentage of female labor. It was decided to take a vote of the employees regarding a change in working hours, which included the change to the five-day week. Almost without exception the men voted for the change, but the women rejected it by a large majority. The reason given was that if they stayed at home on Saturdays they would be expected to help with the house work, while they would much prefer to be at work in the factory.

—W. L. Waterhouse,
Bristol, England.

There is certainly much to be said in favor of giving the five-day week a fair trial. It is not as though it were in the experimental stage. It has been tried and its results have been considered by many to be distinctly encouraging. It is in the human reaction to the question that there is likely to be a flaw.

Both parties in industry must play the game and it must be realized that a certain amount of flexibility is es-

sential. Should there be a rush demand, then it may be necessary to authorize the extra time as overtime. Should the demand be permanent, additional help will doubtless be employed. If it be just a flash in the pan, then the present personnel should certainly cope with the emergency.

—W. R. NEEDHAM,
Stafford, England.

Training Men

I fully indorse Al's method for repetition boring when experts are not available. An expert, if he feels sufficiently sure of himself, can so tutor the semi-skilled that they will soon become efficient. It is well known that similar methods were adopted during the World War, and that even raw material soon surpassed the tutor at some jobs. The semi-skilled already have a groundwork and need a few tips only to proceed satisfactorily.

I do not think there is much in Ed's objection, for what the firm loses by tutoring may be regarded as infinitesimal. If the learner is intelligent, he will soon grasp things and will do without further tutoring.

This, however, must be qualified by adding: It applies to repetition work only. Some jobs require skilled men of experience, and semi-skilled or inexperienced men will prove to be miserable failures. While they may get through the job in some fashion, it will not be sufficiently accurate. If skilled workers leave they cannot easily be replaced. A job that seems easy to the supervisor may be easy only to the expert. Expert workmen are an asset to both the foreman and the concern, and they should be treated with consideration. —WM. BRYCE,
Sheffield, England.

While Ed's plan for training semi-skilled men may work out all right, there are two serious objections to it. One is that the man who is to instruct them may be an expert operator of the machines on which they are to be broken in, and yet may lack the faculty of imparting his knowledge to others. The other that the man giving instruction may feel he is working himself out of a job, and so may not take as much interest in the plan as he should.

A better plan would be to pick out as many men as are necessary for instructors, men who are good all around operators of every machine in the shop, and who are capable of giving instructions to others. Then, put them in charge of instruction and pay them a little more than the regular operators.

Since there are always a few men needed to handle special jobs, repairs, small orders and special parts, these instructors should handle work of that kind also, or possibly they could handle some of the inspecting. In this way it would not add any great amount to overhead, and I think would work out better than the plan proposed by Ed. —THOMAS M. GARRY,
Foreman-Instructor,
Yale & Towne Apprentice School.

Purchased Parts

Al can successfully purchase parts on the outside if he starts soon enough to prepare unequivocal specifications covering material, dimensions, processing, inspection and delivery. Permissible deviations from the basic specifications must be agreed upon by both parties and written into or attached as a rider to the original specifications.

Let Al study his present set-up of men and equipment, carefully weighing shop re-arrangement and two shifts against overtime—all versus outside purchasing. Costs and deliveries will tell the story.

—ROLAND V. HUTCHINSON.

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American Machinist

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McGraw-Hill Publishing Company, Inc.
330 West 42d Street, New York, N. Y.

Chicago, 520 North Michigan Ave.

San Francisco, 883 Mission St.

Aldwych House, Aldwych, London, W.C. 2

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AMERICAN MACHINIST. Published every other Wednesday, price 25c. a copy. Subscription rates—United States, Canada, Mexico and Central and South American countries, $3.00 a year. All other countries (except Europe and British possessions, in Eastern Hemisphere), $6.00 a year or 24 shillings. Entered as second-class matter June 28, 1879, at Post Office at New York, N. Y., under the Act of March 3rd, 1879. Printed in U. S. A. Cable address "McGrawhill, New York." Member of A.B.P. Member of A.B.C. McGraw-Hill Publishing Co., Aldwych House, Aldwych, London, W. C. 2, England, will serve with the European Edition, all subscribers in Europe and British possessions in Eastern Hemisphere—subscription rate 25 shillings for one year.

Volume 79 Number 26

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Printed by The Schweinler Press, N. Y.

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Congratulations

Metal Working Plants!

On entering 1936 at the highest general levels of activity in four long years. Here are just a few of the high spots.

AUTOMOBILES—Sales in motor cars for 1936 will exceed the 1928-29 highs according to automotive manufacturers.

HOUSEHOLD APPLIANCES—Sales in household appliances have been steadily rising with every prospect of continuing through 1936. Figures for 1935 show gains from 10% to 25% over 1934.

RADIOS—Production figures on radios for 1935 indicate at least a 25% increase over the all time high of 1934 of 4,696,000 radio sets.

SHOP SUPPLIES—Purchases are running 65% ahead of a year ago.

MACHINE TOOL ORDERS—Are running above the 1926 average and well over the 15 year average.

METAL WORKING PLANT CONSTRUCTION—Is approximately 121% ahead of last year.

RAILROADS—Have been ordering in steadily increasing quantities.

FOUNDRY EQUIPMENT—Orders are more than double those of last year.

PUMPS—Sales are well above last year.

DIESEL ENGINES—Production will probably be double that of last year, establishing an all time record for Diesel Engine horse power produced.

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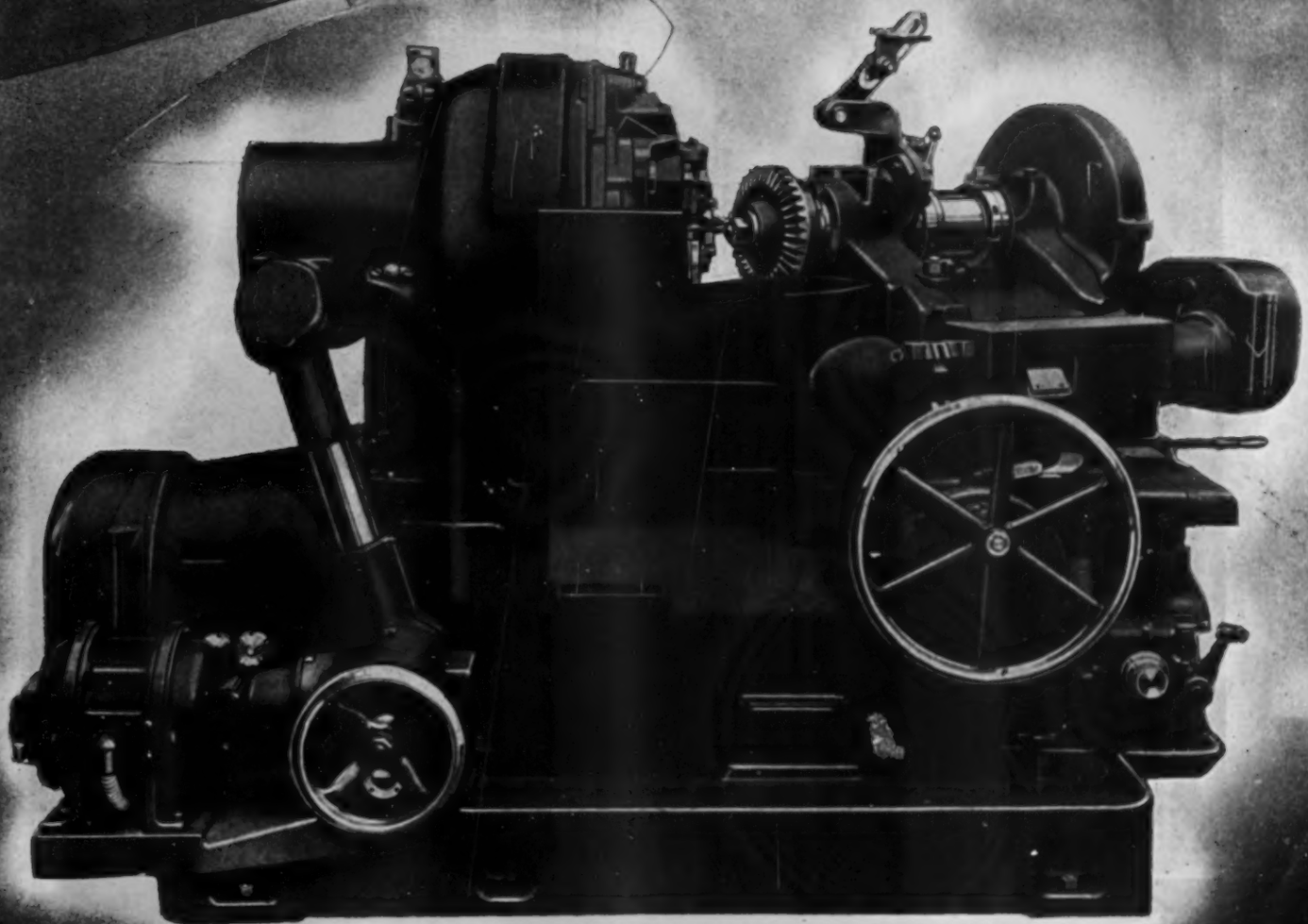
AMERICAN MACHINIST

Achievement

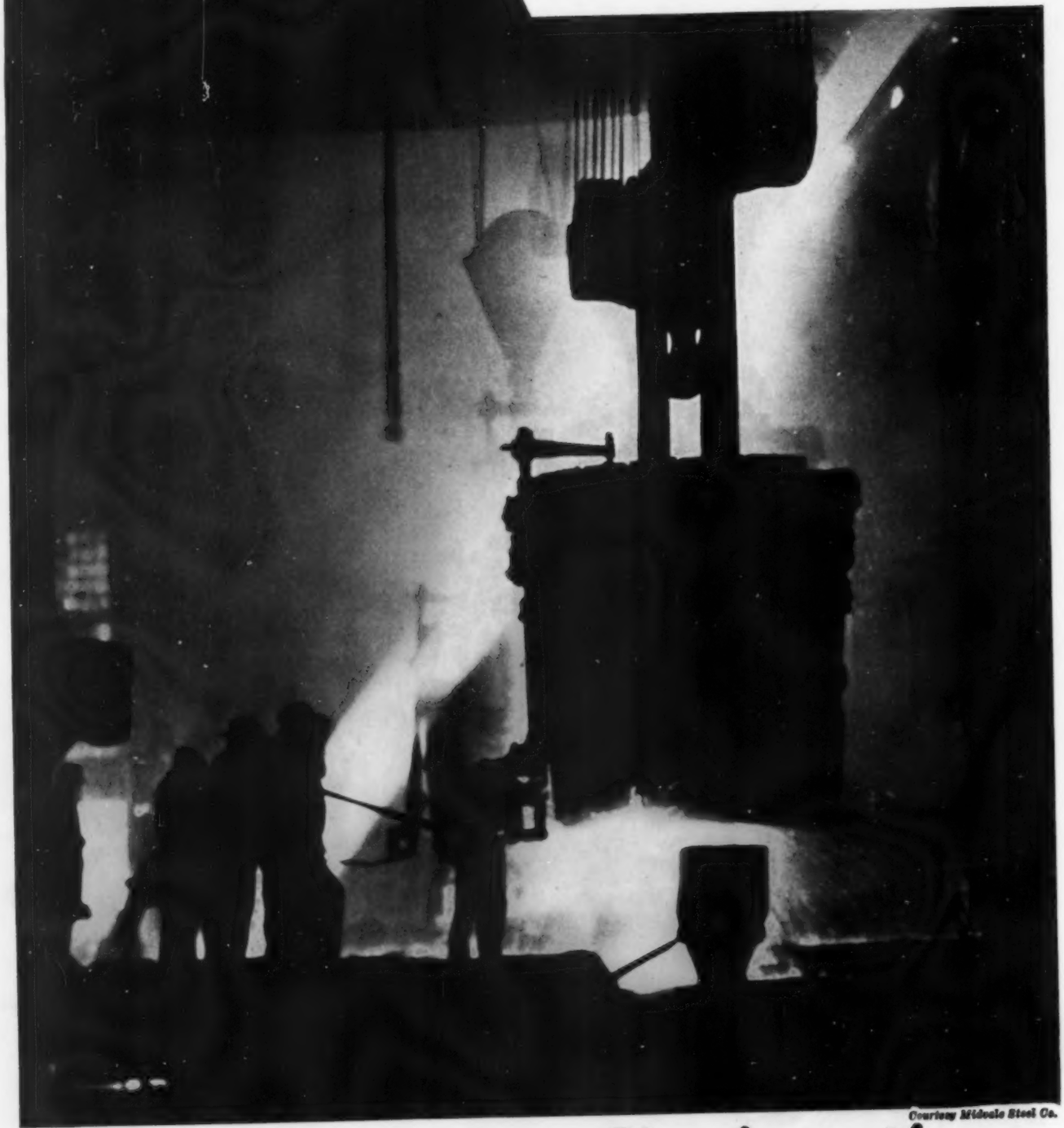
Employment of the 12" Straight Bevel Gear Generator in aircraft work both here and abroad is proof of its ability to meet the precision requirements of a critical trade.

CAPACITY—Gears up to 10 to 1 ratio, 24" pitch dia., 3 dia. pitch, 3-1/2" face



GLEASON WORKS ROCHESTER, N.Y. U.S.A.

STEEL and



Courtesy Midvale Steel Co.

Visit us in Cincinnati . .

Lodqe & Shipley Lathes

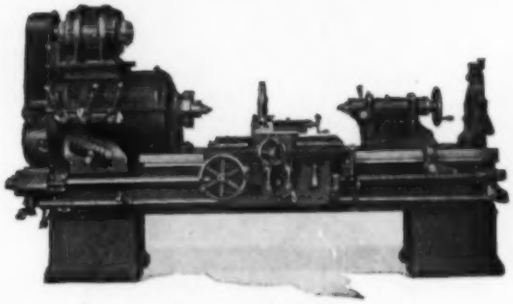
The Steel age is the fourth of the cultural ages of man, and Steel today rules the industries of the world as it dominates the history of the age.

Builder of empire — leveler of nations — backbone of war — guardian of peace, the very foundations of today's world rest upon Steel. From a shimmering stream of molten metal to countless millions of finished products Steel has placed new demands of accuracy and precision upon the machine tools used in its fabrication.

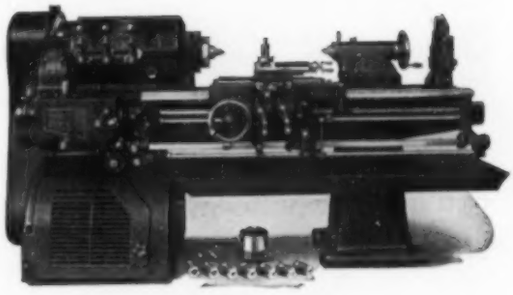
Whether in the construction of heavy mill machinery or in the innumerable manufacturing processes of modern industry Lodge and Shipley lathes have set a new standard of precision and reliability. Many thousands of satisfied users give ample testimony of the ability of Lodge and Shipley lathes to meet the exacting requirements placed upon them.

Confidence in Lodge and Shipley lathes is by no means confined to any one industry. Leading manufacturers in every industry throughout the world recognize the built-in quality of Lodge and Shipley lathes.

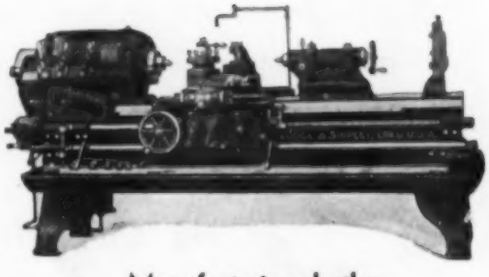
LATHES *Good* LATHES ONLY!



Engine Lathes



Tool Room Lathes



Manufacturing Lathes

THE LODGE & SHIPLEY MACHINE TOOL CO.

The MACHINE *BEHIND* THE MACHINES

CINCINNATI

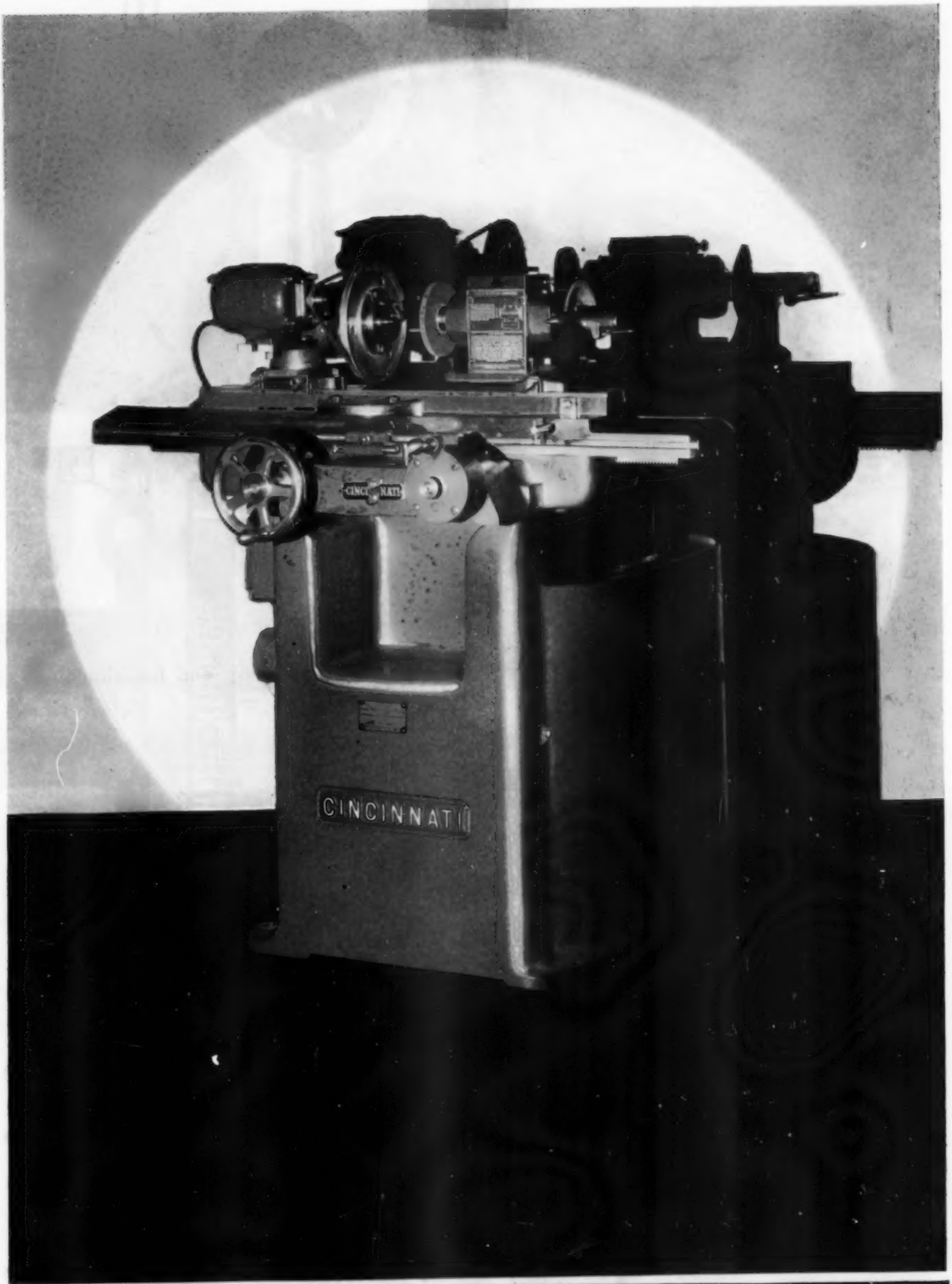
Correctly sharpened tools, quickly available, are one of the basic requirements necessary to keep your machinery working in a lock-step pace with your production schedule. The Cincinnati No. 2 Cutter and Tool Sharpening machine fulfills this requirement. Accurate cutting and clearance angles, the very essence of a free cutting tool, are quickly and easily obtained on this machine.

Your tool maintenance gang will like the Cincinnati Cutter Grinder, because it is so easy and convenient to operate. Improved controls and adjustments enable them to do many sharpening jobs 15 to 25% faster, and incidentally to quickly end the clamor of the machine set-up men when a sharp cutter is required in a hurry. Unusual flexibility permits a large variety of milling cutters, reamers, hobs, form tools, etc., to be easily and accurately ground.

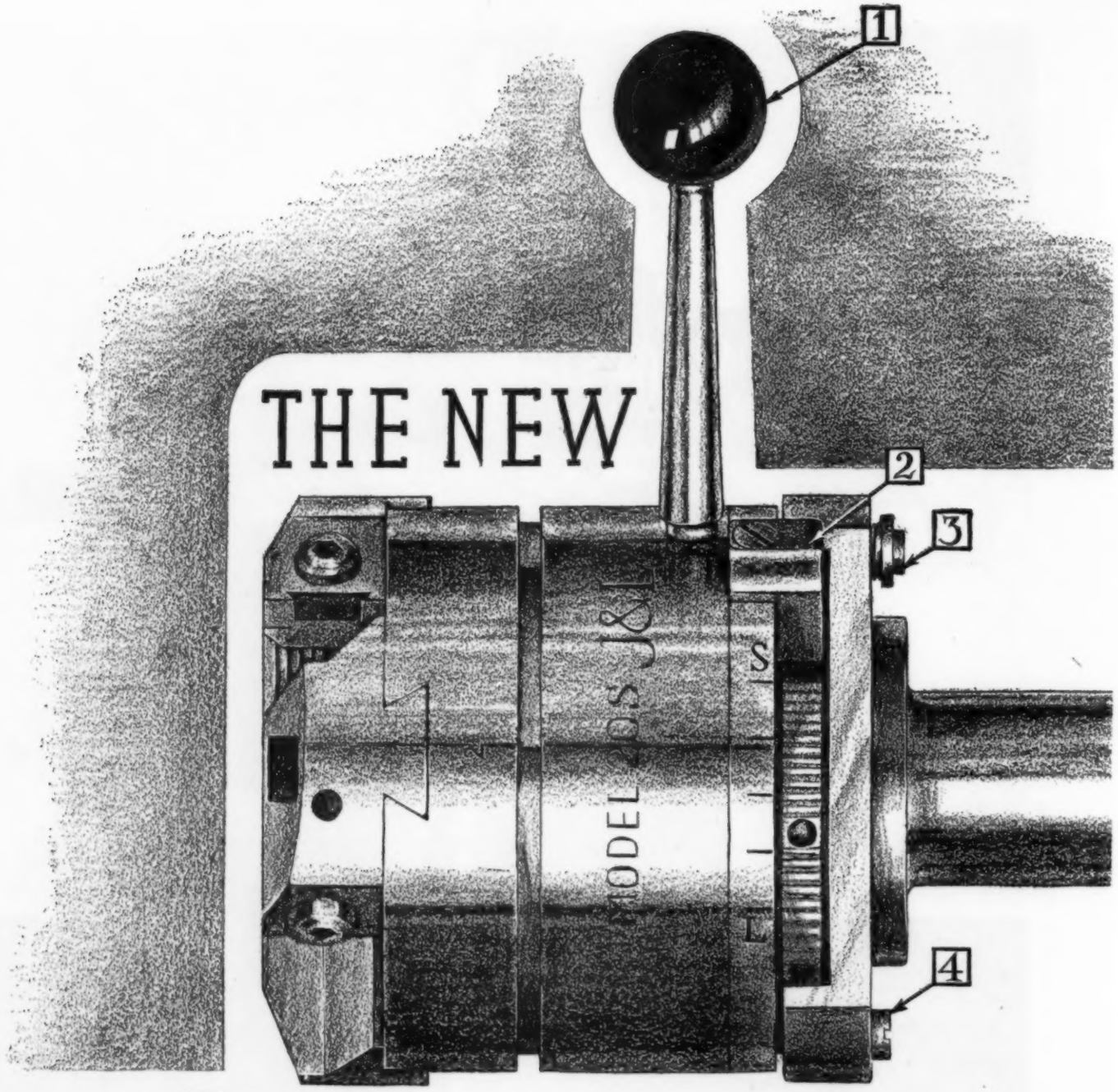
May we suggest that you investigate the performance of the Cincinnati No. 2 Cutter and Tool Sharpening Machine? Write for the Facts on Features booklet M-647.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI, OHIO, U. S. A.

THE CINCINNATI No. 2 UNIVERSAL



TOOL AND CUTTER GRINDER . . . .



1 **HANDLE (locks or trips die at any time)**

2 **LOCKING PAWL (rapid, accurate pitch diameter adjustments)**

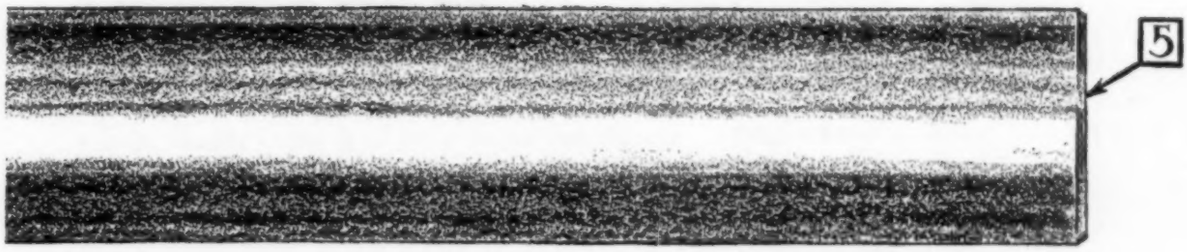
3 **LONGITUDINAL FLOAT (lets chaser reproduce its own accuracy)**

4 **CUSHION START (eases chaser onto work)**

5 **ECCENTRIC FLOAT (takes care of any misalignment of die and work)**

JONES & LAMSON MACHINE

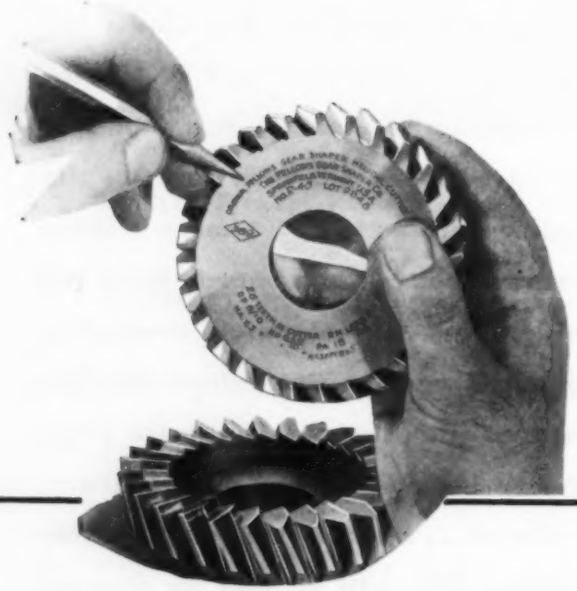
J&L DIE



Hardened and ground throughout AND lapped on the face and in the dovetail slots, the new J & L Tangent Die is a model for precision thread cutting tools. . . . Only ONE SET of Chaser Holders is required for any right-hand thread within the Die capacity. Ground-in-the-thread Chasers are serrated on the back, engaging corresponding serrations in the Chaser Holder so that, after sharpening, accurate setting is assured. With the Chaser overhanging the Holder and the chamfer remaining constant, a close-to-shoulder cut is certain throughout the life of the Chaser. . . . These features, plus those on opposite page, make the J & L Die outstanding for ease of set-up, accuracy, and low cost per acceptable thread. . . . Details on complete line of J & L Stationary and Revolving Dies will be sent on request.

COMPANY, Springfield, Vermont, U. S. A.

MORE GEARS PER GRIND
MORE GEARS PER CUTTER...
WITH ORIGINAL FELLOWS



ORIGINAL FELLOWS

is a mark of identification so important in its guarantee of cutter quality that we etch it on every cutter. Look for it! . . . None genuine without this marking.

GEAR SHAPER CUTTERS

YOU MAY THINK YOU ARE. BUT I WANT TO TELL YOU THAT OUR GEAR REJECTIONS SHOW A LARGE INCREASE.... ALSO OUR INSPECTION COSTS ARE UP.

WISH YOU WOULD GIVE THAT "FELLOWS" MAN AN ORDER FOR ORIGINAL FELLOWS CUTTERS. BELIEVE THEY ARE WORTH THE DIFFERENCE IN PRICE.

WHY! JUST FINE! THOSE ORIGINAL FELLOWS CUTTERS HAVE CUT OUR REJECTIONS TO THE VANISHING POINT. WE'LL SPECIFY FELLOWS IN THE FUTURE.

True economy in gear cutting depends upon ultimate costs; and in this connection, the initial cost of a Gear Shaper Cutter is of insignificant importance when compared with the number of gears it will cut between "grinds," the total number of gears cut by the cutter, and the number of gears that pass inspection.

Users of ORIGINAL FELLOWS CUTTERS get more gears per grind, more gears per cutter, and produce fewer rejects. Figured on this basis ORIGINAL FELLOWS CUTTERS are the most economical. This is no idle statement; we can substantiate it with facts, or we can prove it for you in your own plant and on your own work.

The superior quality of Fellows Cutters is the cumulative result of years of intensive engineering investigation and the investment of thousands of dollars in special cutter grinding and inspection equipment.

ORIGINAL FELLOWS CUTTERS are not made to "sell at a price," but to produce satisfactory gears. It is also to your advantage, as a user of the Gear Shaper, that there be no divided responsibility as between the Gear Shaper and the Cutters used on it. As makers of the Gear Shaper and Gear Shaper Cutter, we know that where accuracy is demanded, complete control over both machine and cutter is absolutely essential.

For your own protection and profit insist on: ORIGINAL FELLOWS GEAR SHAPER CUTTERS.

THE FELLOWS GEAR SHAPER COMPANY

78 River Street, Springfield, Vermont
616 Fisher Building, Detroit, Michigan

We specialize in the manufacture of complete equipment for cutting, finishing, and testing gears — write for new general catalogue.

FELLOWS
~ GEAR SHAPERS ~
AND GEAR SHAPER CUTTERS

746

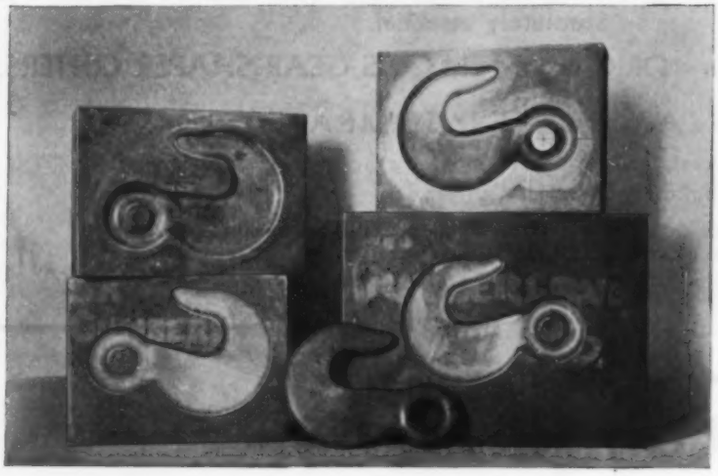
The KELLER METHOD

Die casting die for an automobile radiator grille. The roughing cut in solid steel and a small part of the finishing cut are clearly shown. The Keller Machine is of great value not only in producing the die casting impressions, but in milling the intricate parting lines, so important in accurate die casting work.

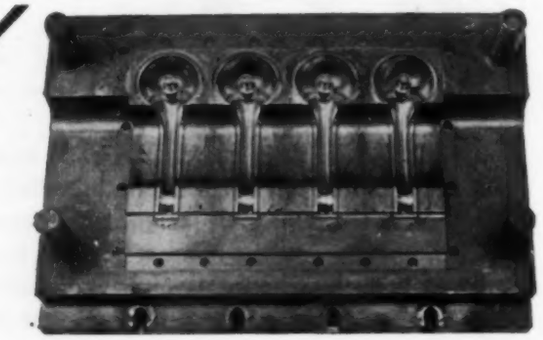
THE Keller Method makes remarkable savings in the production of dies or any other work having irregular outlines or surfaces. A combination of the two major characteristics designed into every Keller machine makes this possible.

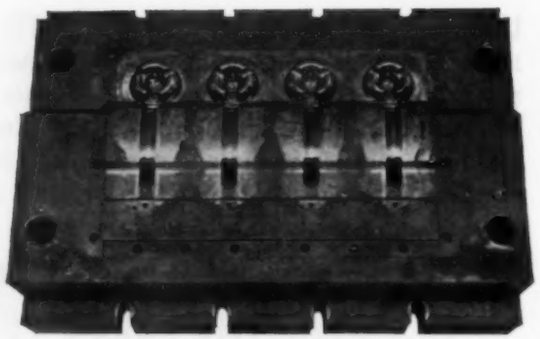
First, each type and size of Keller machine possesses a range of power, feeds and speeds, to employ the ideal milling cutter for every job within its range to the maximum capacity of that cutter under all conditions. Any irregular job that can be milled on any machine can be milled better and faster on a Keller. Many jobs which cannot be milled by any other method can be milled on a Keller. Cutters of a diameter of $\frac{1}{8}$" or less can be automatically fed through tool steel. The touch of the most skilled operator, feeding by hand under the same conditions, would not be delicate enough to avoid breakage. Heavy roughing cutters remove metal to the limit of their capacity, yet they are automatically protected against breakage when greater depths or unexpected hardness of the material are encountered.

This small cam lever was machined all over in quantities of 75 to 250. A finished lever as master and a simple fixture for locating the work were all that were necessary for economical production on the Keller Machine.



Forging dies for a heavy hook produced on a Keller Automatic Tool Room Machine. Heavy metal removing ability is an important factor in work of this nature.





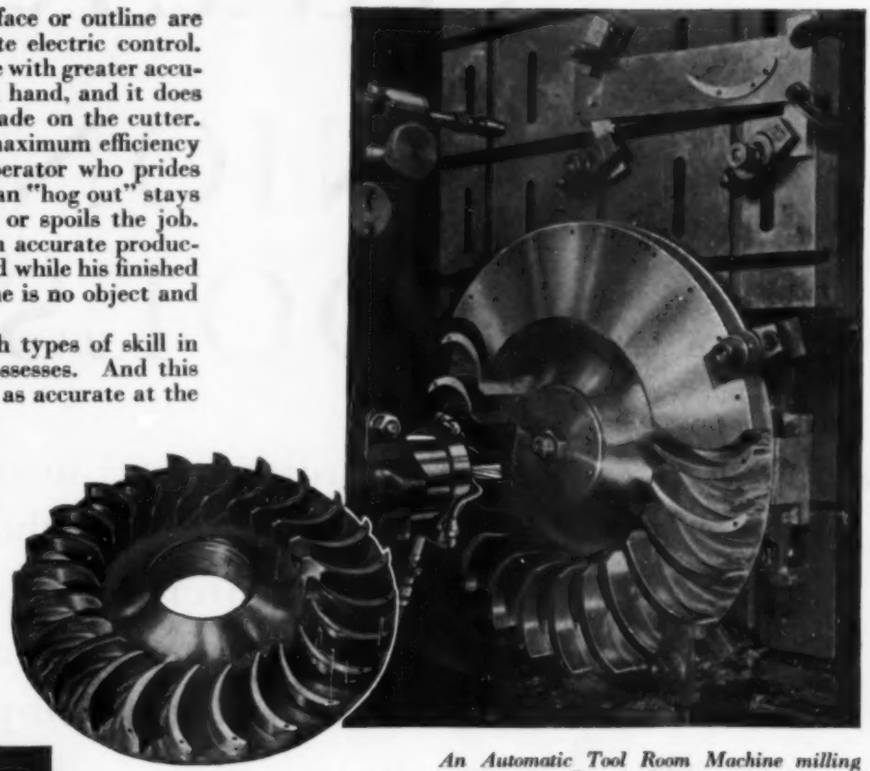
Multiple impression molds for bakelite electric fan designed for handsome streamline appearance. The irregular impressions were easily and quickly milled from the solid on a Keller Automatic Tool Room Machine, Type BL.

PRODUCES PROFITS

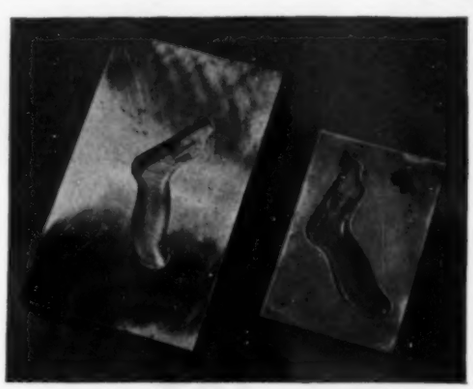
Secondly, the irregularities of surface or outline are automatically produced by a delicate electric control. The electric tracer guides the machine with greater accuracy than any human eye or human hand, and it does this irrespective of the demands made on the cutter.

No hand operation can combine maximum efficiency in both of these functions. The operator who prides himself on the speed with which he can "hog out" stays well away from his finished surface or spoils the job. The operator who is highly skilled in accurate production moves slowly and cautiously, and while his finished work may be beautifully precise, time is no object and his tool never works to capacity.

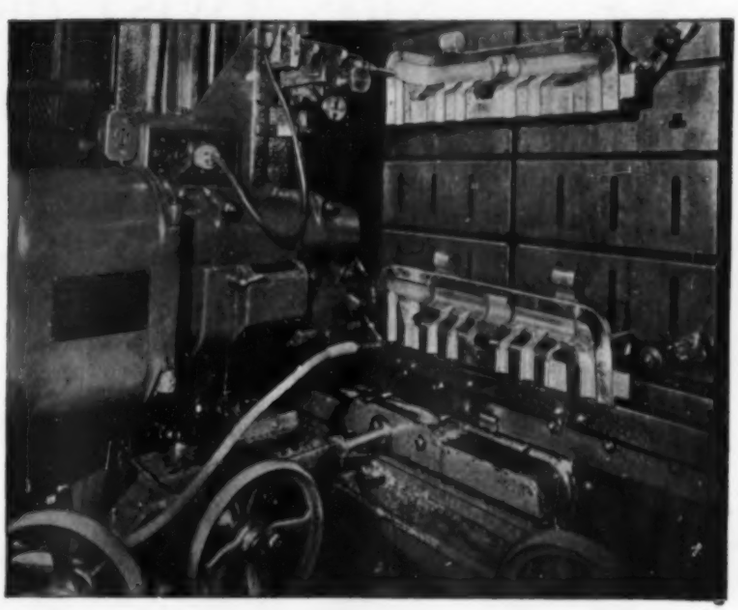
The Keller Method combines both types of skill in greater measure than either man possesses. And this skill is built into a machine which is as accurate at the end of a long day as at the beginning, which employs it to your advantage year after year and which leaves your skilled human operators free for the essential hand finishing which is their rightful function.



An Automatic Tool Room Machine milling a turbine impeller wheel from a solid steel disc. As each vane is produced from the same master, identical shapes are assured.



Forming die for a hacksaw handle with artificial stone model from which it was produced on the Keller Machine. This job was produced so accurately that sample forms were readily drawn after the feed lines were ground out. After the blank was found, blanking tools were also produced on the Keller Machine.



Exhaust Manifold Core Box produced in quantity for a large automobile manufacturer. These core boxes come off the Keller Machine identical and interchangeable.

PRATT & WHITNEY CO.

HARTFORD, CONN. KELLER DIVISION

DRILLS
REAMERS
DIES
TAPS

Quality UNION TOOLS

"The Tools you buy again"

CUTTERS
SCREW PLATES
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By standardizing on Union Tools you can simplify the problem of interchangeable fabrication and insure new standards of economy in production.

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Makers of All Kinds of Cutters, Twist Drills, Reamers, Taps, Dies, Etc.

S. W. Card Mfg. Co. Division, Mansfield, Mass.
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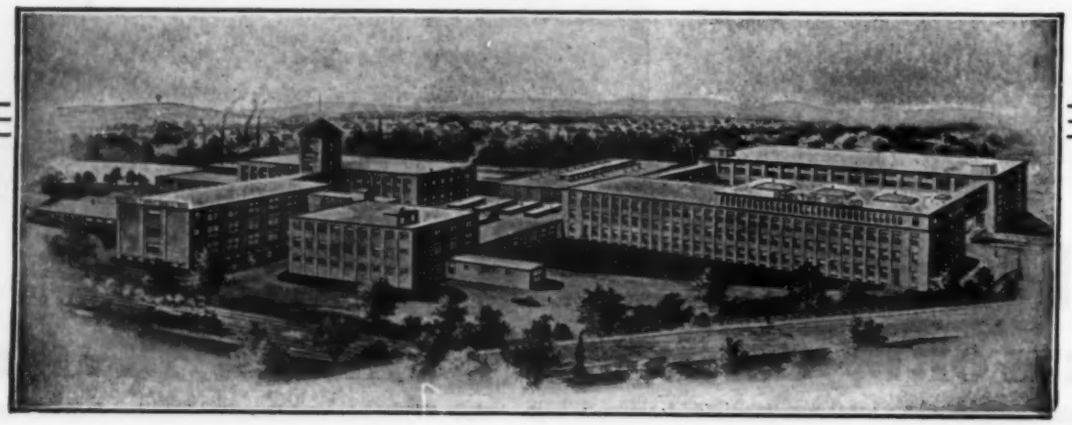
Representatives throughout the world.



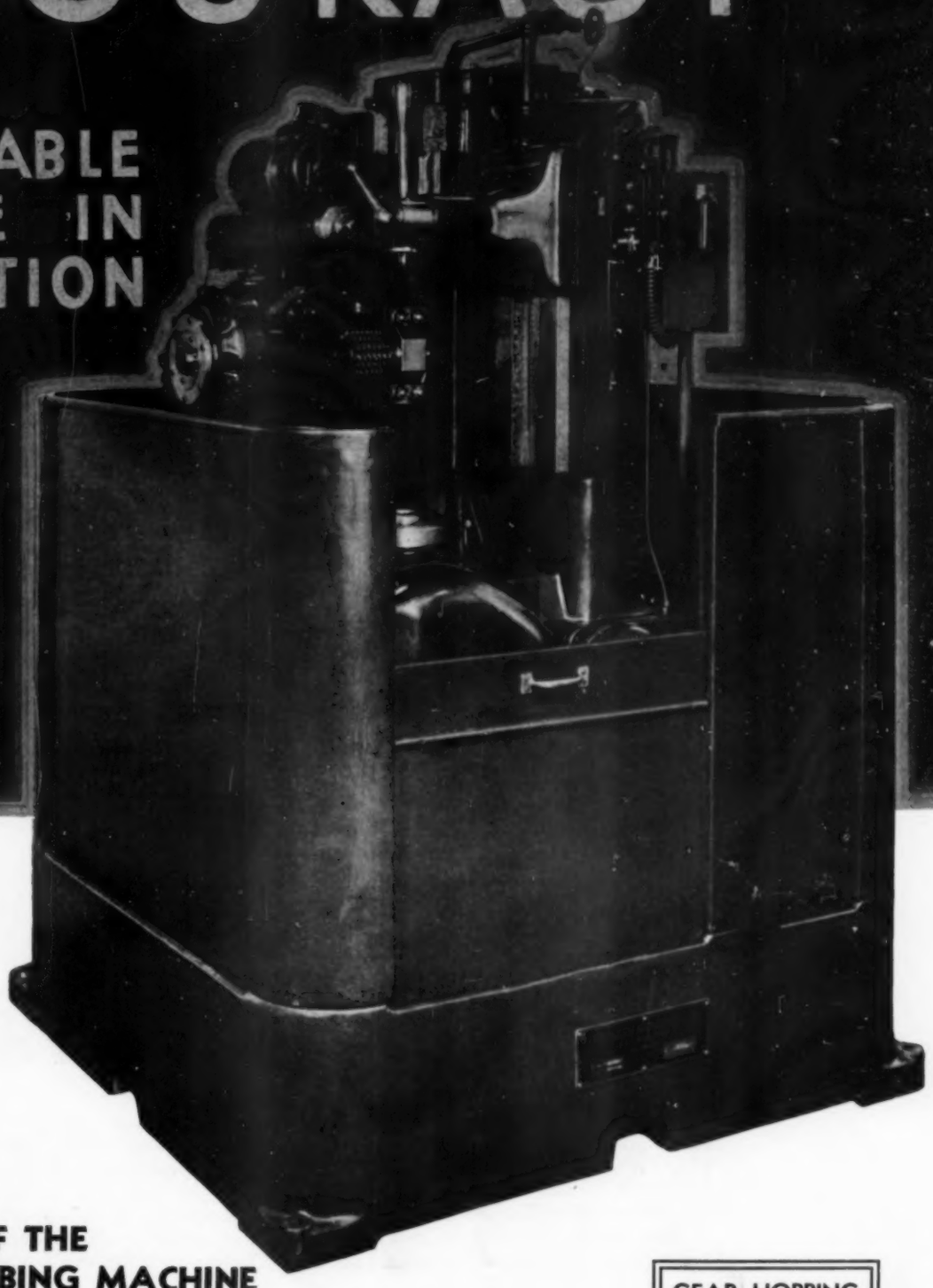
ACCURACY

with

REMARKABLE INCREASE IN PRODUCTION

with

Automatic Hobbing Machine



MODEL—6-S
MODEL—7-S
MODEL—12-S

ADVANTAGES OF THE AUTOMATIC HOBBING MACHINE

A — Speed and ease of operation

B — 25% to 30% faster than any other machine

C — 25% greater hob life

D — The automatic depth feed against a positive micrometer stop insures uniformity of diameter

E — Clearing work for the return stroke avoids drawing cutter back through the cut

F — Operator does not have to operate a quick return or approach as the machine does this automatically

G — Operator does not have to back cutter out of work at completion of cut as this is automatic

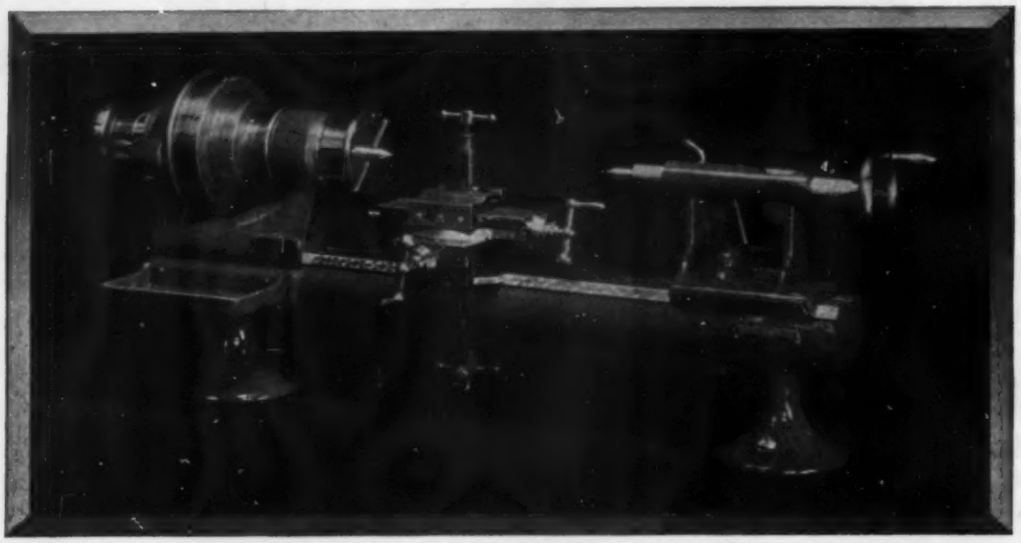
H — This automatic operation provides operator with ample time to handle several machines, since all he does is load and unload the work in the machine

GEAR HOBBING MACHINES
•
THREAD MILLERS
•
GEAR GRINDERS
•
GEAR TESTERS

The **LEES-BRADNER** *Co., 6210 Carnegie Ave., Cleveland, Ohio*

Yes . . . HARDINGE OFFERS TWO DISTINCT TYPES OF PRECISION BENCH LATHES

And . . . EACH TYPE IS AVAILABLE IN FIVE SIZES—1/2" to 1" Collet Capacity—7" and 9" Swing



OPEN CONE STYLE—FLAT BELT DRIVEN

ENCLOSED HEAD STYLE—VEE BELT DRIVEN

Make certain that you have a proposal and complete information from HARDINGE—there is a HARDINGE Precision Bench Lathe to meet varying requirements and conditions.

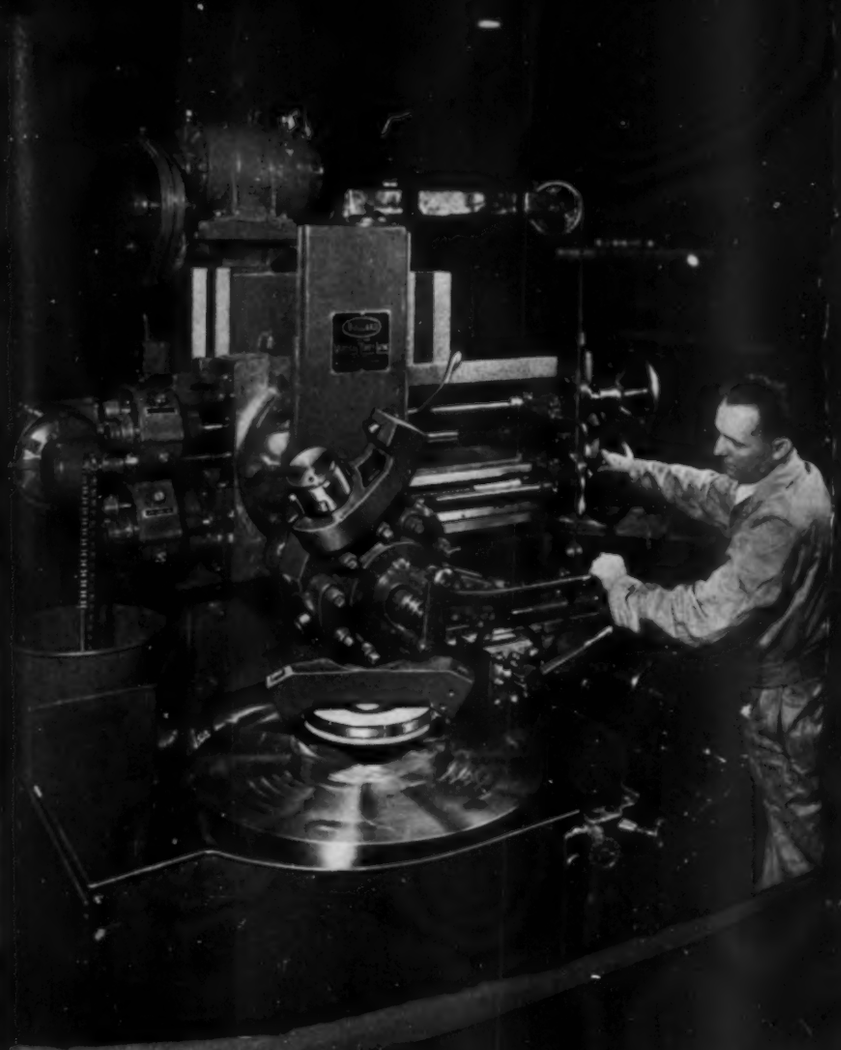
The improved design, desirable features, variety of attachments and modern electrical driving units will be immediately apparent. In addition, the increased collet capacity, high spindle speeds, accuracy and ease of operation are some of the reasons why HARDINGE installations are being made in ever-increasing numbers—Ask for our complete catalog.

Cataract

PRECISION BENCH LATHES—HAND SCREW MACHINES—MILLING MACHINES

HARDINGE BROTHERS, INC. . . . . ELMIRA, NEW YORK

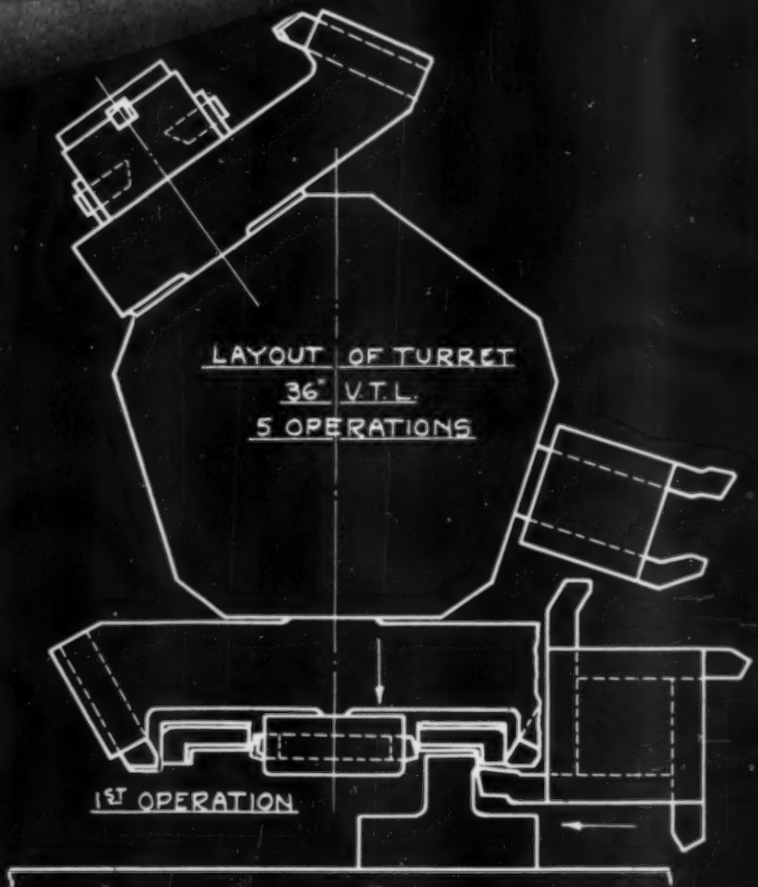
CHICAGO NEW YORK DETROIT

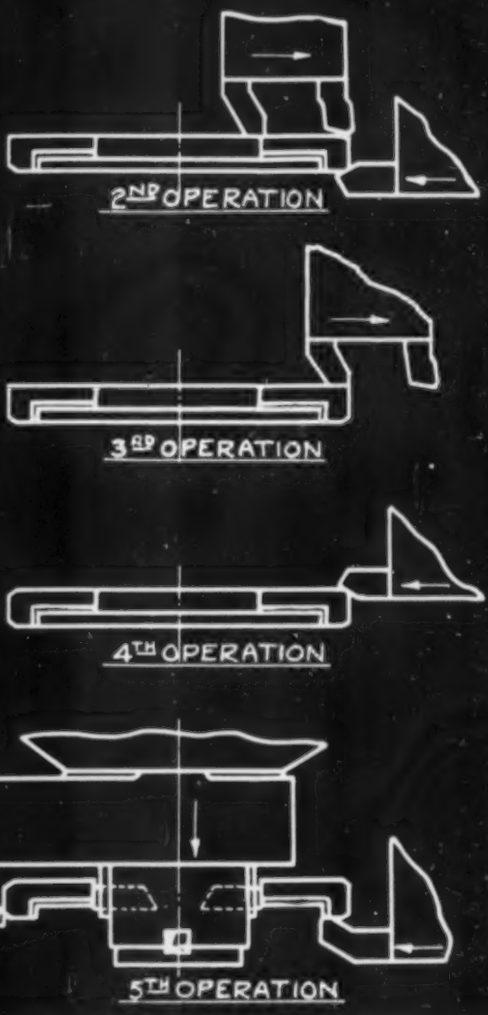


TIME SAVED
is
MONEY EARNED

Best Previous Time on this Alloy Bronze Casting - Feed Worm Wheel - was 12.01 min. Bullard High-Speed Vertical Turret Lathe Time with Group Tooling is 3 minutes, 41 seconds. This shows a saving of 8 minutes, 19.6 seconds per piece machining time.

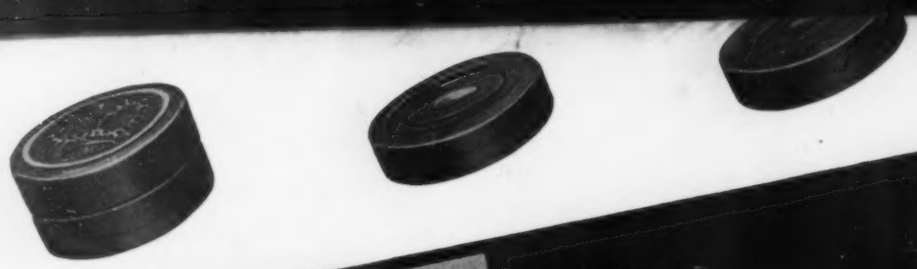
Operations as follows: Rough Bore, Turn and Face, Champfer - Finish Face - True Bore, Finish Turn and Ream.





BRONZE WORM GEAR MACHINED ON HIGH SPEED VERTICAL TURRET LATHE

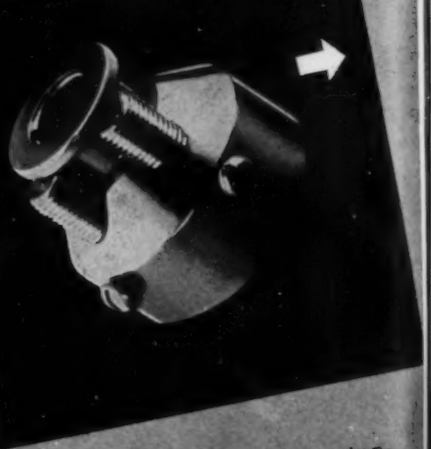
THE BULLARD COMPANY BRIDGEPORT CONN.



This manufacturer uses Carpenter Stainless No. 8 -- not only for its free machining qualities -- but because of its resistance to scaling at high temperatures. This is a burner igniter electrode.

Imagine trying to handle this job with a Stainless Steel that was not free machining. No. 8 made the job easy. Close tolerances are easier too with this Free Machining Stainless.

Plenty of machining on this gauge valve. No wonder this is a popular application for No. 8. Its free machining properties keep the costs down--thanks to the addition of that rare element, Selenium, pioneered by Carpenter.

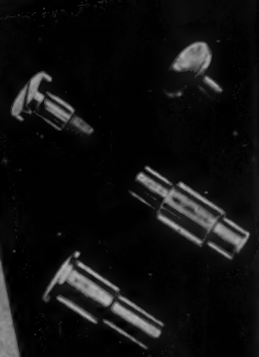


Look at the clean machining--the smooth, beautiful finish. The high corrosion resistance of Carpenter Free Machining Stainless No. 8 was equally important in this spindle for a machine that makes salt tablets.

The deep drilling operation on this thermometer well requires a Free Machining Steel so Carpenter No. 8 won out. Diameter of hole 11/32". Depth of hole 31/4". Try No. 8 yourself. Drill it -- tap it.

Make a move for

All these pieces are made of Carpenter No. 8 -- the most corrosion resisting Free Machining Stainless available. Lower the cost of using Stainless. Take advantage of the free machining qualities of No. 8. Test it! Prove its economy!

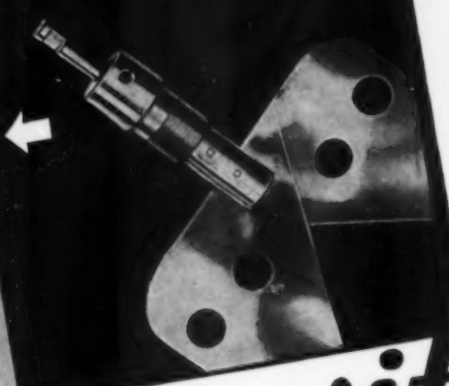


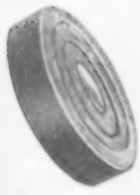
"Easy to cut" was an important consideration in selecting the right Stainless for this gear assembly. No. 8 has the added advantage of hardening rapidly when subjected to peening or heavy pressure.

One look at this soft-drink dispenser and you can realize that No. 8 gives you lasting beauty along with free machining economy. No. 8 is immune to corrosion of practically all foodstuffs and sterilizing solutions.

"You can thread No. 8 three times as fast as ordinary 18-8 Stainless," said the operator. This bolt was machined from a cold drawn hexagon bar of Carpenter Stainless No. 8 at a saving that brought production costs in line.

Foods won't corrode this agitator. The blades are punched from Carpenter No. 4 Strip. The shaft is machined from No. 8 Bar Stock--which machines in automatics at 60% to 70% of the speed of ordinary screw stock.





LOWER COSTS with Carpenter STAINLESS

Give this faster-machining Stainless Steel a chance to bring down your Stainless costs. There is a Carpenter Stainless to fit every need. To help you select the proper one, send for this handy slide chart that gives you, at a glance, technical data on all Stainless Steels. It's Free. Send today!

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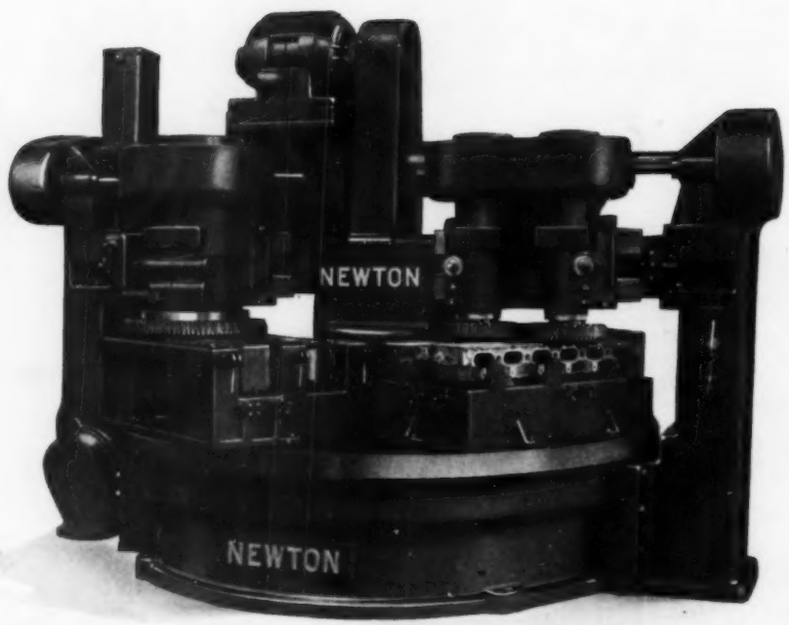
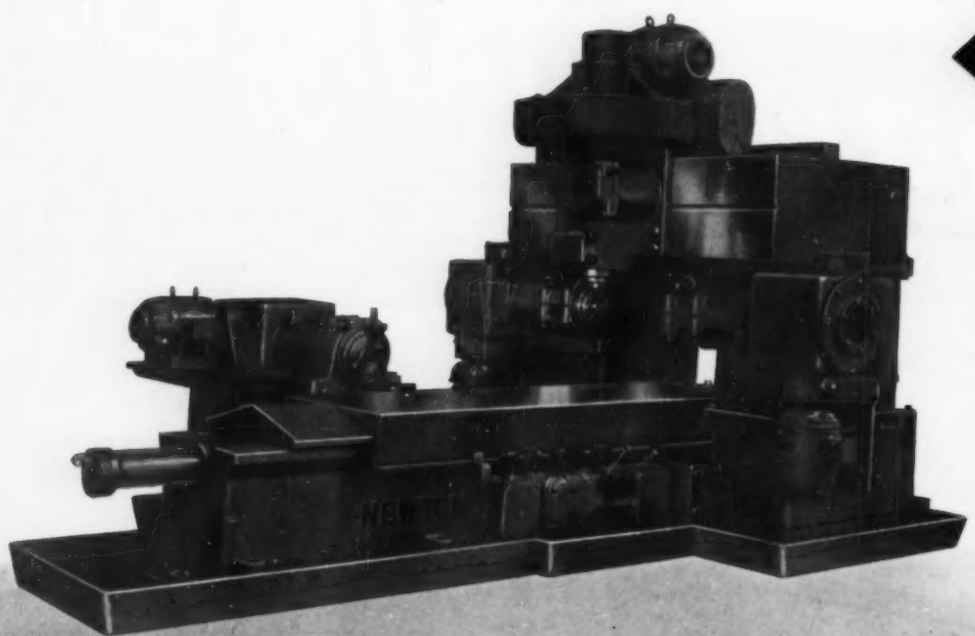
CONSOL MACHINE

NEWTON

CONTINUOUS MILLING MACHINES

Are built in light and heavy patterns, are used extensively in the Automotive and Tractor Industries, also on parts for refrigeration machines, vacuum cleaners, washers, electrical appliances, etc. Machine at the right is the heavy type shown roughing and finishing cylinder heads and water jackets.





NEWTON

STRAIGHT LINE MILLING MACHINES

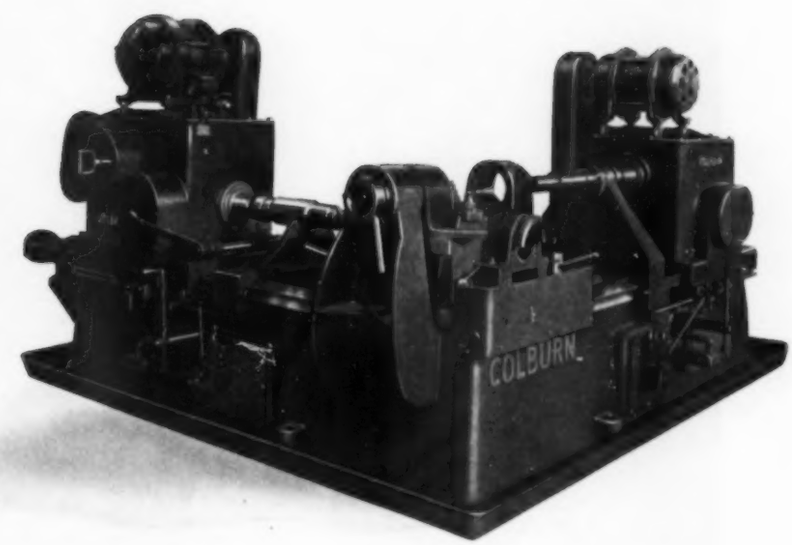
Are built in a wide variety of designs including Hydraulic or Mechanical Feeds, with from one up to ten or more spindles mounted in unit heads individually motor driven. Adjustable trip dogs are provided with hydraulic feeds for regulating length of feed and rapid traverse.

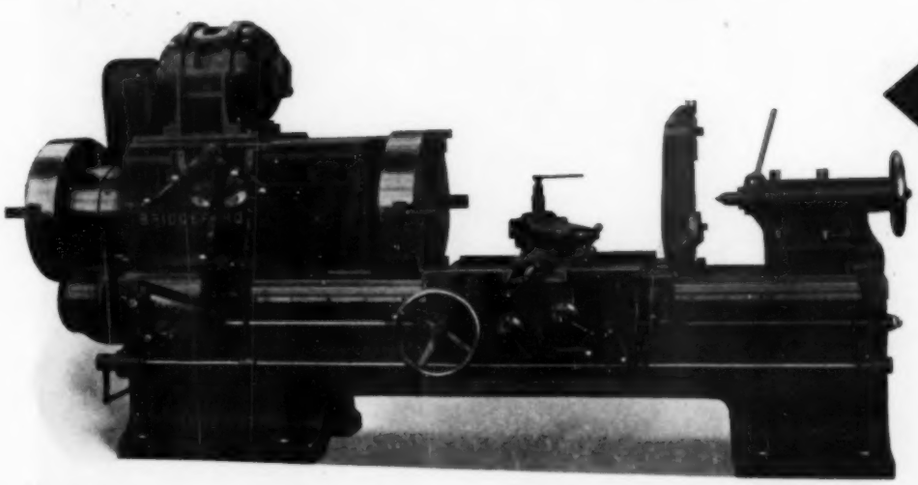
IDATED TOOLS

COLBURN

HYDRAULIC FEED BORING MACHINES

Are built for boring, drilling, facing and tapping. The machine shown is a two spindle two way Hydraulic Feed Boring and Tapping Machine. It is equipped with indexing fixture and is arranged for boring and tapping worm gear housings.





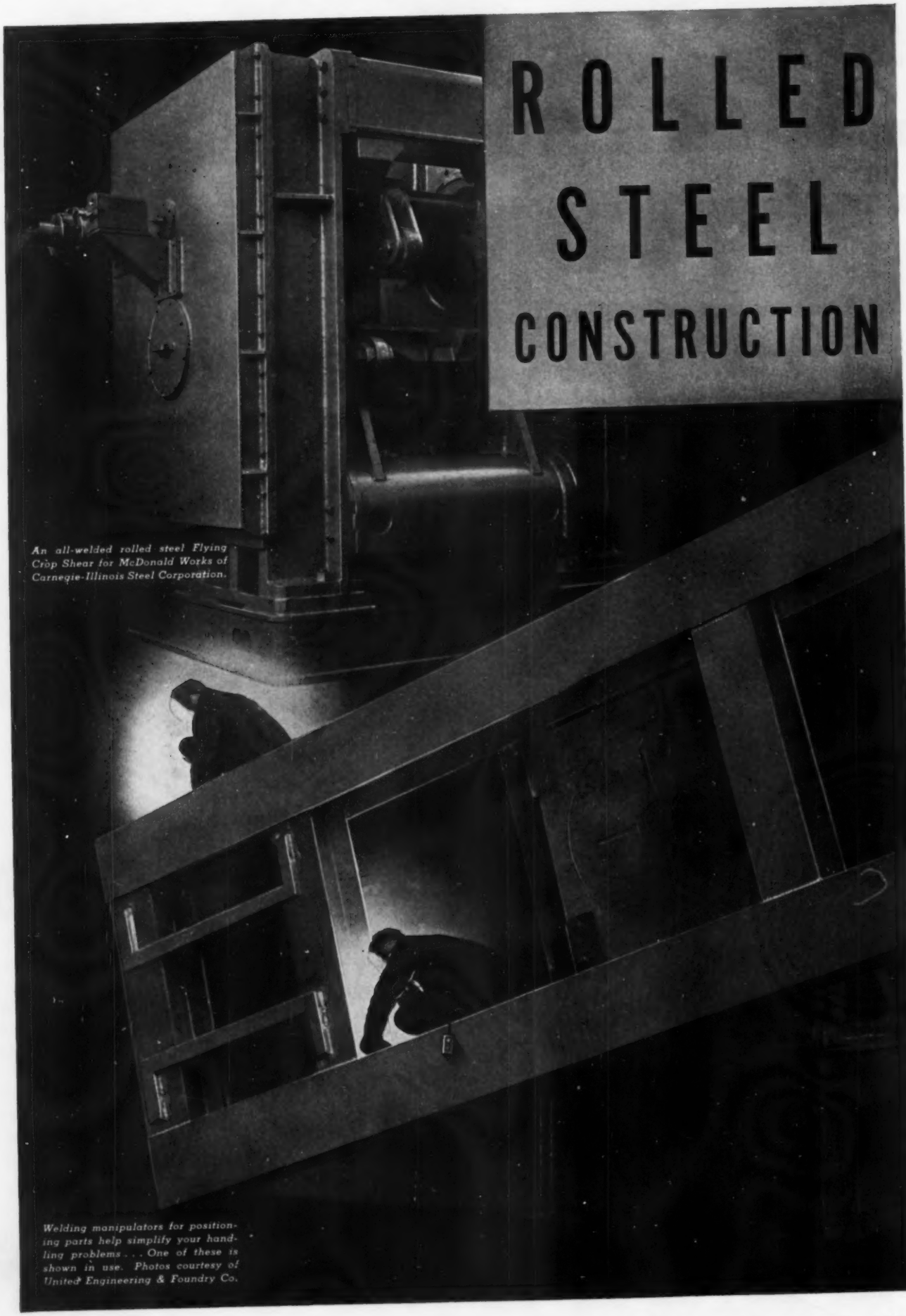
BETTS-BRIDGEFORD

ENGINE LATHES

Built from 24 inch swing up to any requirement of swing and length. At the left is shown the 26" Hollow Spindle Lathe, the recognized standard in Oil Country shops and plants producing oil well equipment. Other lathes of modern design are built for use in every industry, as well as specialized equipment for Railroad Shops.

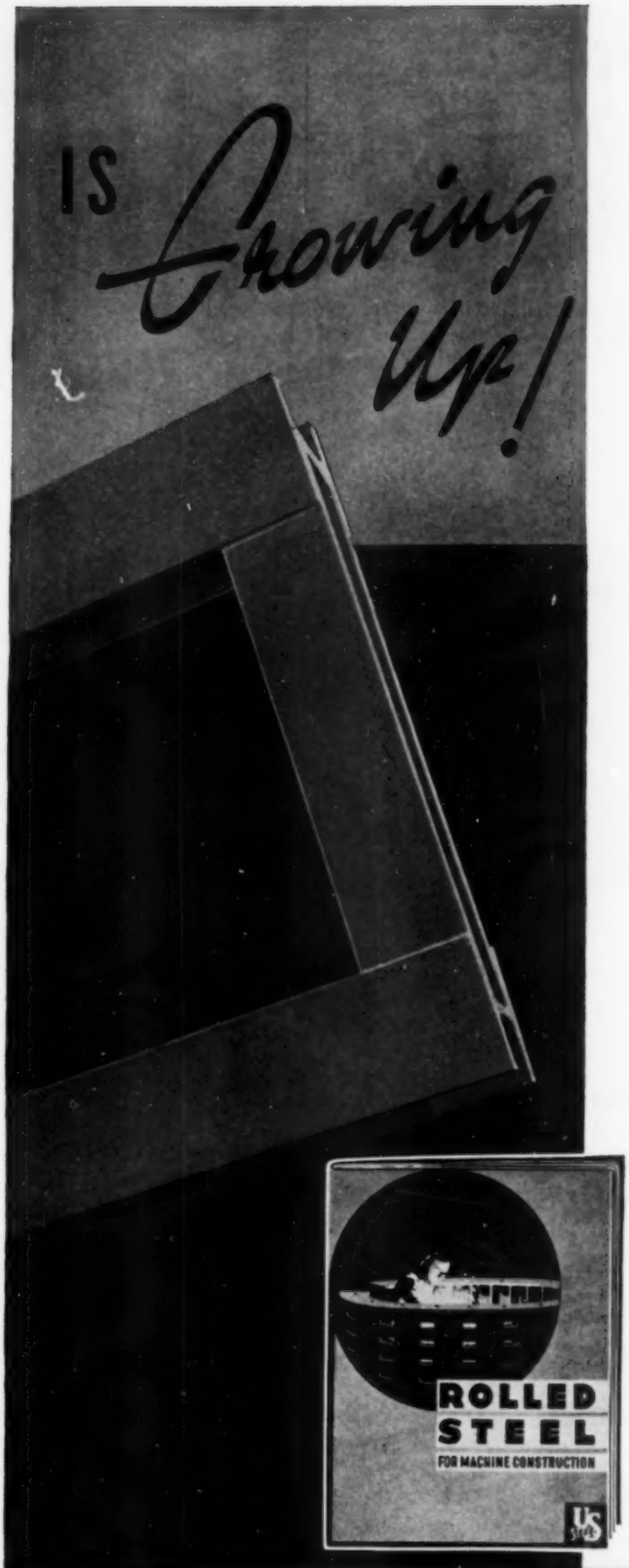
Consolidated Machine Tools are built under the following Trade Names:
BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK



An all-welded rolled steel Flying Crop Shear for McDonald Works of Carnegie-Illinois Steel Corporation.

Welding manipulators for positioning parts help simplify your handling problems . . . One of these is shown in use. Photos courtesy of United Engineering & Foundry Co.



FOR many years, the use of rolled steel in machine construction was confined to simple parts such as bases, frames and cover plates. As welding and flame-cutting practices have improved, the use of rolled steel has rapidly expanded. The machine designer has recognized the economy and the adaptability of rolled steel. He is no longer hampered by old restrictions of design. He has known factors of strength with which to deal. Weight and bulk can be reduced. The sales angle of pleasing appearence comes in for consideration. Reduced inventory, lowered production costs, quicker deliveries—all of these advantages of rolled steel have created a new horizon for the machinery field.

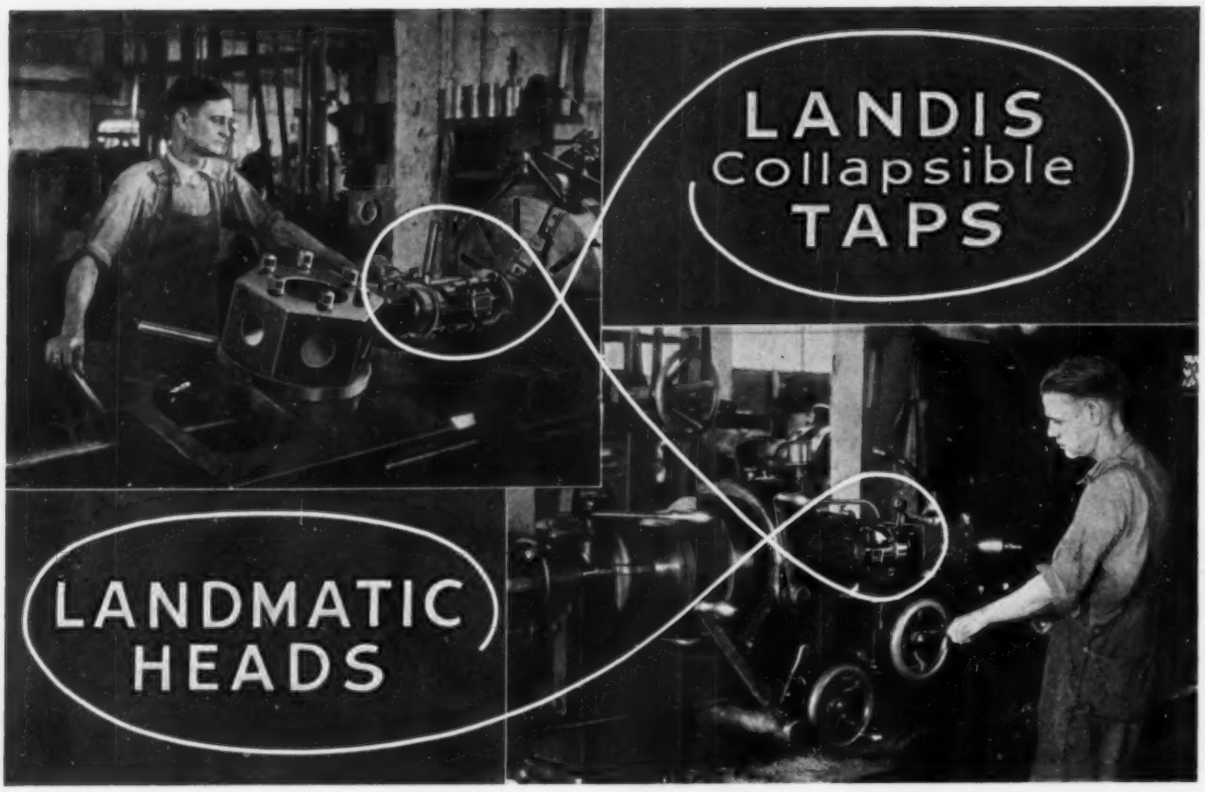
Helpful suggestions for the efficient and economical use of steel are contained in the new booklet, "Rolled Steel for Machine Construction." It was prepared for the Executive, responsible for keeping his product modern and competitive . . . for the Engineering Department, responsible for design . . . for the Production Department, responsible for manufacturing operations . . . for the Purchasing Department, responsible for the judicious and economical buying of materials. Your copy is awaiting your address.

CARNEGIE-ILLINOIS STEEL CORPORATION

PITTSBURGH, PA. ● CHICAGO, ILL.

United States Steel Corporation Subsidiary

A winning combination . . .



. . . for turret lathe production

To insure the best results in threading and tapping operations on your turret lathes, you can't do better than select LANDIS Equipment.

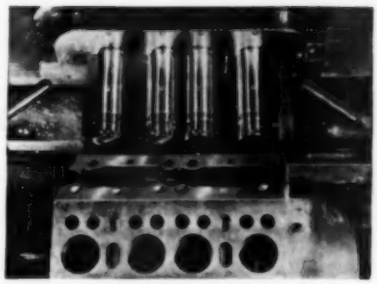
LANDMATIC Heads and LANDIS Collapsible Taps — a winning combination!

Here there is no question of divided responsibility — nor need there be a question. These LANDIS Threading Tools have the rigidity and accuracy for modern production requirements. They also have the flexibility and long tool life which alone insure economical operation.

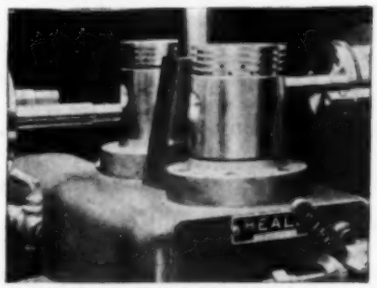
Details? Write us today.

LANDIS MACHINE COMPANY, Inc.

Waynesboro, Penna.



Carboloy—precision-boring hard C.I. cylinders on Ex-Cell-O P.B. Machine. 460 S.F.P.M., .008" feed, cut 6" lg. x .008" per side. .0003" max. limits for round, straight and surface variations.



"Borizing" wrist pins, holes of aluminum pistons using Heald No. 49 Borematic. 2000 r.p.m. Feed per minute: 8" rough, 4" finish. Depth of cut: .020" rough, .010" finish. Carboloy tooled.

"Splitting hairs 10 times" is common practice in precision boring. Tolerances of .0003" and less must be held. To do this job economically you need a tool that holds its microscopically keen cutting edge for long, economical periods.

Diamonds used to be the answer—but NOW its Carboloy Cemented Carbide. With Carboloy precision boring tools you get long life between grinds and eliminate all diamond hazards of non-uniformity, cracking and loss. Carboloy tools give you a high degree of accuracy, mirror-finish and low tool cost per piece.

Write today for full details and costs, no obligation.

A typical Carboloy precision boring tool. Extensively used to get a high degree of accuracy, mirror-finish and low tool cost per piece. Any style to meet your requirements available.

CARBOLOY COMPANY, INC.
DETROIT, MICHIGAN
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REG. U. S. PAT. OFFICE
CEMENTED CARBIDES

Carboloy Company, Inc.,
2989E. Jefferson Ave., Detroit, Michigan

Without obligation, furnish full details and costs of Carboloy precision boring tools on this job.

Machine:_____

Diameter and length of tool:_____

Material bored:_____

Name_____ Title_____

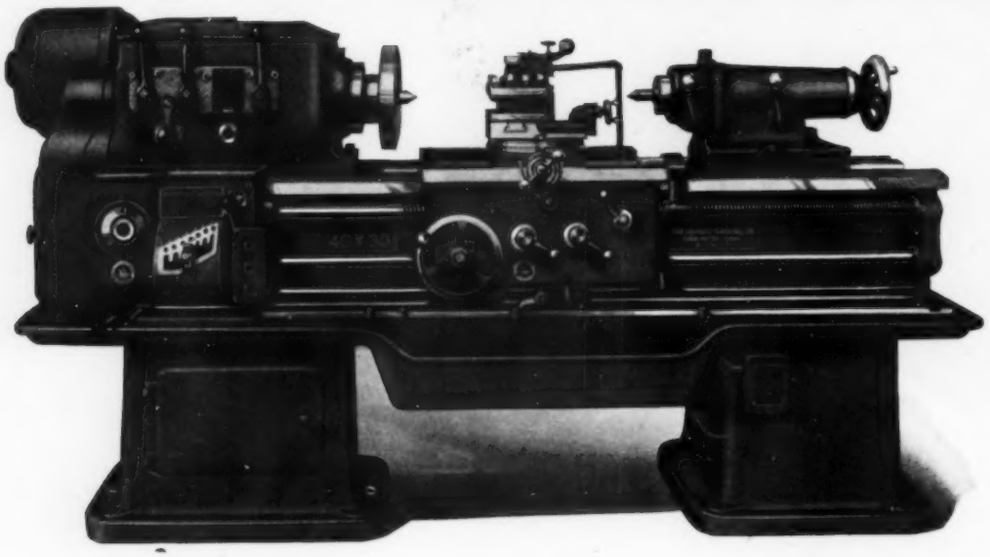
Company_____

Street_____

City_____ State_____

A new HENDEY

. . . with Speed and Power for Heavy



THE HENDEY 4-C Manufacturing Lathe has every modern feature, for fast, low cost, high quality production . . . . .

A SUPER DEVELOPED ENGINE LATHE that accepts the demand of the buyer who wants to be shown that it will do his work faster and better, and then proves it in an impressive and decisive fashion.

High speed turning is but one of its major features: it is also capable of a wide range of thread cutting; and for chucking work the spindle is bored to take a bar 1½″ diameter.

The massive tail stock, furnished with fixed center or live center with anti-friction bearings, is fully capable of carrying all the load placed on it under maximum working conditions.

And then, this lathe embodies known Hendey quality in design and workmanship, the culmination of over 60 years of persistent determination to make nothing but the best.

LET HENDEY ENGINEERS HELP

THE HENDEY MACHINE COMPANY

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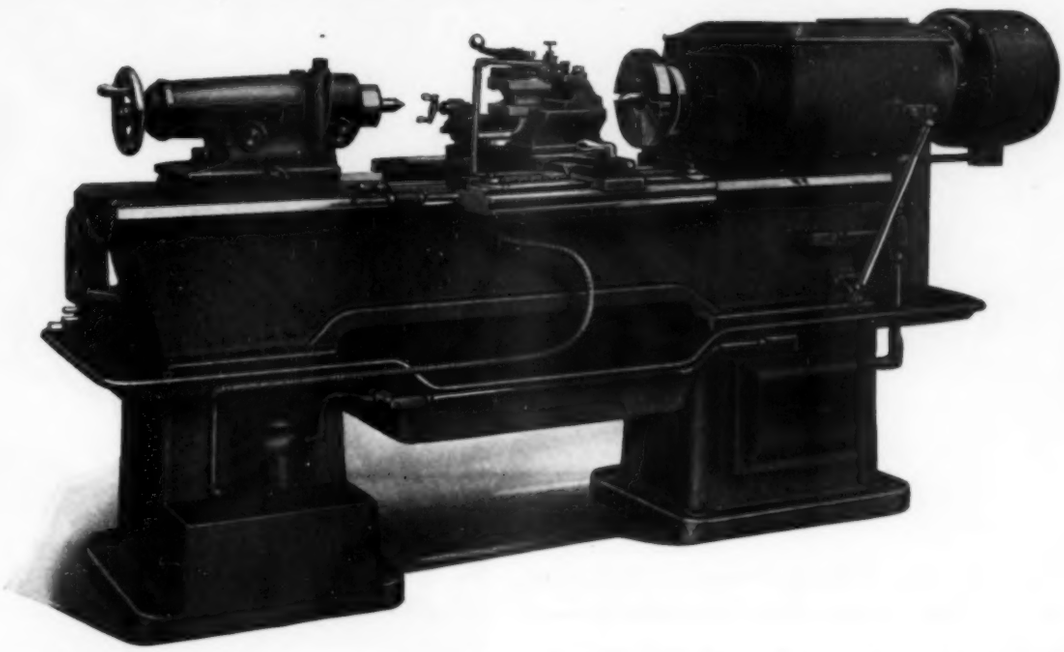
MANUFACTURING LATHE

Duty Production at Low Cost



The headstock has 12 spindle speeds, ranging from 30 to 1200 r.p.m., in geometrical progression. Gears are oil hardened and slide on multiple splined shafts for speed changes.

The 7½ hp. constant-speed reversing type motor is flange-bolted to end of headstock casting. Rotor shaft transmits motion to power-input shaft of head through multiple-disc clutch running in oil. Motor is operated through start, stop and reverse push button control.

The spindle runs in pre-loaded precision anti-friction bearings. Anti-friction bearings are also used in the spindle speed change mechanism, and all gears, shafts and bearings are splash oiled.

The gear box has 28 quick changes of threads and feeds with a range of 2¾ to 40 threads per inch and feeds of .005 to .073 per inch. Gear Box mechanism is automatically oiled.

The lead screw is driven from the gear box through a positive toothed clutch. The feed rod is driven through a safety-type slip clutch. When either one is running the other is disengaged.

The apron is a box-type, one-piece casting. Cross and longitudinal feeds have positive clutch engagement with quick-acting lever controls. Apron, carriage, and cross-slide, are all automatically oiled from oil reservoir in lower half of apron, with sight gauge to show oil level.

OPTIONAL EQUIPMMENT

The Heavy Duty Tailstock is furnished with a special spindle with a quill for center running in precision anti-friction bearings. This changes the center from a fixed to a live center, especially adapted to high speed turning, as the center turns with the work. Center may be forced out on end of spindle feed screw. Spindle is clamped by two independent binders to hold it in alignment.

Multiple graduated dials on cross-feed screw for repeated setting of tool for different diameters.

Motor-driven pump and piping for tool coolant with remote control switch.

Taper attachment; 4-way tool block; Rear tool block; Multiple feed stops; Micrometer Carriage stop; Thread chasing dial; Motor and starting equipment.

SOLVE YOUR LATHE WORK PROBLEMS

. . . TORRINGTON, CONNECTICUT

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UP...DOWN...IN...AROUND

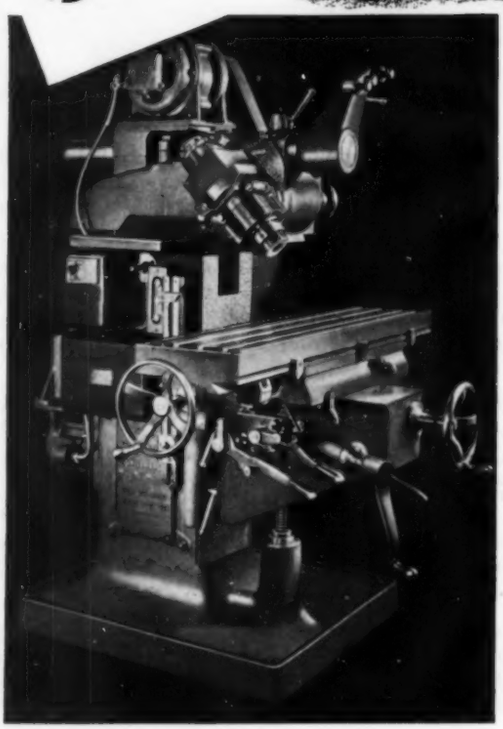
THE CUTTER-HEAD FOLLOWS YOUR HAND...

...Saves set-ups

With the Van Norman Universal Miller you avoid the extra set-ups that hold up production and run up costs.

Almost as easily as swinging your hand, you swing the cutterhead into working position for milling vertical, horizontal and *angular* surfaces. Settings are quick, accurate. Convenient attachments make it easy to reach out-of-the way surfaces on complicated pieces, adapt the machine for profiling, slotting and high speed routing—all without disturbing the original set-up. You save the time usually lost in making repeated set-ups and carrying the work from machine to machine.

If you run a tool room, pattern shop, experimental or short-run production department—*and want to cut as much as 50% from your floor-to-floor* time—write for bulletins describing the various sizes of Van Norman Millers.



The Van Norman No. 22 Miller—an essential machine for tool rooms, pattern shops and for short-run production. Power feed throughout.

VAN NORMAN

VAN NORMAN MACHINE TOOL CO., *Springfield, Mass.*

2073

Drawn for Revere Copper and Brass Incorporated by Edward P. Cotton

Call to Meeting

One of Paul Revere's first copper and brass assignments was to recast the bell for the Old North Church, the church where the warning lanterns in the belfry started Revere on his memorable ride to Lexington. When the bell was finished, its tone was so wonderfully clear and true that similar orders came thick and fast. In all, 396 bells were cast for various New England churches; seventy-five of these are known to be still in use. But Revere bells, brass cannon, copper spikes and rivets were soon supplemented by a still greater achievement.

In 1801, Revere mastered the secret for rolling copper, a process never before accomplished in America. Copper sheets from his new mill soon protected the hull of the famous frigate "Old Ironsides," the roof of the Boston State House, and many other public and private buildings up and down the coast.

Paul Revere's ability as a copper and brass manufacturer, inventor, and industrialist is still serving America. Through succeeding generations, the original firm of Paul Revere & Son has grown and consolidated to the present nation-wide organization of Revere Copper and Brass Incorporated.

The Revere heritage of leadership in discovering new applications for copper and brass has also been continued. If you have a problem for which copper or one of its alloys might prove the answer, we invite you to consult with our Technical Advisory Service.

For complete technical data on any of our copper products, address our Executive Offices.

We are happy to take this opportunity to wish you a very Merry Christmas and a Bright and Prosperous New Year.

Revere Copper *and* Brass

INCORPORATED

FOUNDED BY PAUL REVERE 1801

EXECUTIVE OFFICES: 230 PARK AVENUE, NEW YORK CITY · MILLS: BALTIMORE, MD. · TAUNTON, MASS.
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STEEL SHEETS for EVERY PURPOSE

Adapted to all Machinery and Construction Uses

THE wheel of human progress has turned fast and traveled far to reach this era of metals, machines and miracles in which we live. Sheet Steel is today the basic material for a multitude of products and structures. Forming the hub of this progress is the volume of high grade sheet steel products made by this Company.

To enable buyers and users to recognize these quality materials instantly, they are branded AMERICAN. Supplied in Black and Galvanized Sheets, Tin and Terne Plates. If *maximum rust-resistance* is an essential, look for the KEYSTONE in trade-mark; it identifies the *original* Copper Steel. Write for descriptive literature.

AMERICAN SHEET AND TIN PLATE COMPANY, Pittsburgh, Pa.

Steel Sheets are also manufactured in the South by Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

Sheets and Tin Plates produced on the Pacific Coast by the Columbia Steel Company, San Francisco, Calif.

Sales Offices in principal cities. *Export Distributors for above Companies*— UNITED STATES STEEL PRODUCTS COMPANY, Hudson Terminal Building, 30 Church Street, New York, N. Y.

United States Steel U.S. STEEL *Corporation Subsidiaries*

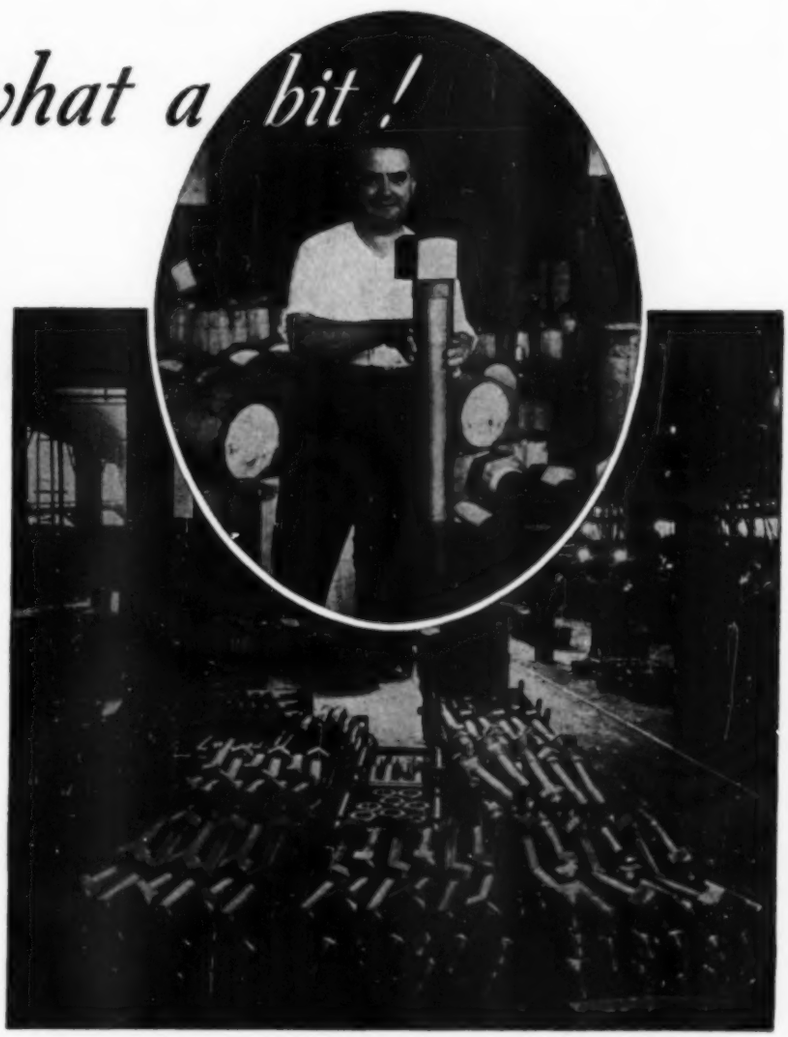
ENDURO

REPUBLIC'S PERFECTED STAINLESS AND HEAT-RESISTING STEELS

Licensed under Chemical Foundation Patents Nos. 1339317 and 1339318

DOES ITS BIT FOR *Boulder Dam*

. . . and what a bit!



When Uncle Sam does things, he does them right—that's why these vital parts for the emergency gates and needle valves of this big dam were made of Republic Alloy Steels—and many of them of ENDURO, Republic's Perfected Stainless Steel.

These items varied in size from tiny pieces weighing one-seventh of an ounce to huge studs and bolts that a man can barely lift. Specifications were most rigid. Every single piece, and there were hundreds of them, had to be perfect to satisfy the engineers who inspected before shipment.

ENDURO came through with flying colors. Machining—threading—tapping—all operations were performed with standard equipment—proof of the workability of this ace of stainless steels.

Just as ENDURO will serve for many years in the vital parts of this huge project, so it is now serving in countless places in industrial equipment where resistance to corrosion, wear and high temperatures, combined with great strength, makes its use a worth-while investment.

Outline to Republic metallurgists where you may now be considering the use of stainless steel and receive their recommendations.

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ALLOY STEEL DIVISION · · · MASSILLON, OHIO

With — new production standards demanding better tooling equipment

Buy — dependable CUTTERS *that fully meet the new demands*

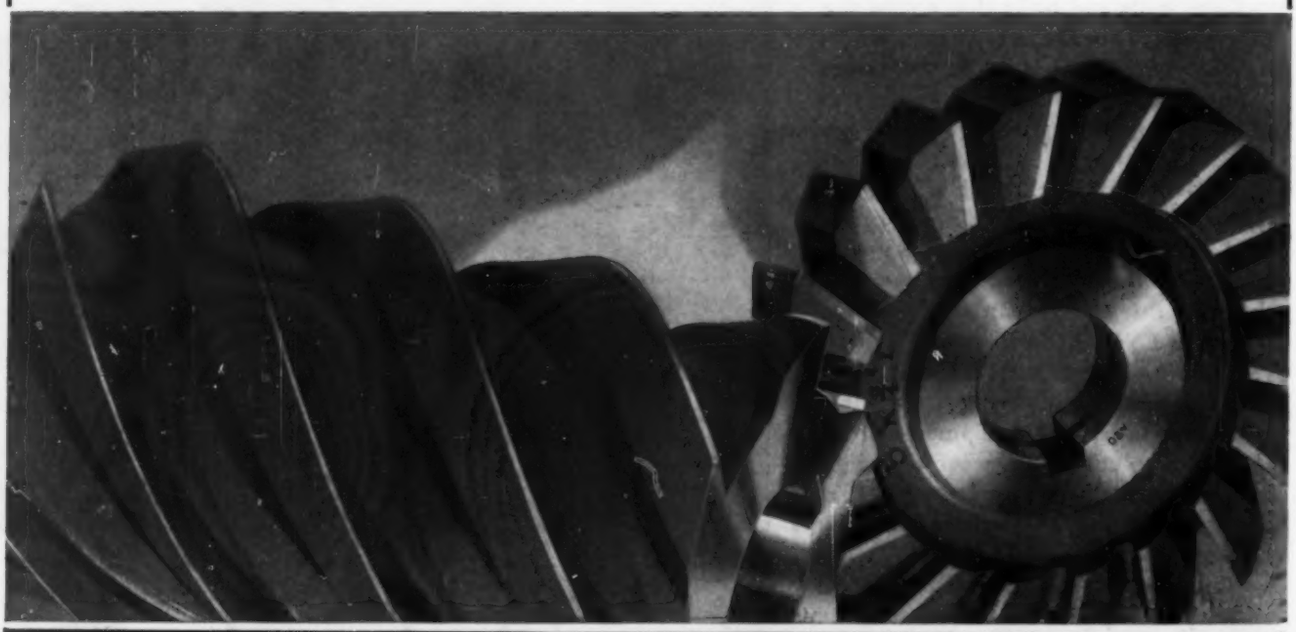
Put cutters on your machines that will permit realizing the maximum production schedule—cutters that will stand up under severe service with minimum sharpening.

You will save in every way with Brown & Sharpe Cutters on the job—their QUALITY assures you of getting lowest REAL cutter cost.

B·S

Use our New No. 32 Catalog as your buying guide for reliable cutters.

Brown & Sharpe Mfg. Co. Providence, R. I., U. S. A.



Brown & Sharpe Cutters

MODERN — EFFICIENT — KEEP COSTS LOW

Steels

for every need of the die maker

DIES impose many different combinations of exacting requirements on tool steels. Among the various grades of Bethlehem Die Steels one can be found that fits exactly into the set of conditions surrounding each class of service.

Bethlehem makes three grades of water-hardening die steel—X, XX and XCL. For work in which an oil-hardening steel is considered desirable Bethlehem Tool Room Oil-Hardening Tool Steel is recommended.

Whatever grade is selected the user is assured of a die steel manufactured at every step in accordance with the most up-to-date practice, representing generous value.

When it comes to blanking, stamping and similar dies for unusually long runs in service involving severe abrasion, Bethlehem Lehigh Die and Tool Steel is the material to use. This is a high-carbon, high-chromium die steel of the air-hardening type. The following figures will give some idea as to what may be expected of this steel: Pack-hardened at about 1850 deg. F. and drawn at 400 deg. F. a Rockwell-C hardness of 61 and Brinell of 600 are obtained.

For other requirements Bethlehem makes other tool steels equally outstanding in their fields. See the complete listing of Bethlehem Tool Steels on the next page.

BETHLEHEM STEEL

AT EVERY STEP WE ASK:

"Which Method will make the best TOOL STEEL?"

AT every stage in the manufacture of Bethlehem Tool Steels there's just one basis for determining the process to be followed. The answer to the question, "*Which method will make the best tool steel?*" solely decides the equipment and method that we use.

This policy has led to adoption of the following processes, which are outstanding features of practice in the Bethlehem Tool Steel Plant:

HIGH-FREQUENCY INDUCTION MELTING Bethlehem Tool Steels get the right start by melting in the high-frequency electric induction furnace, which makes steel to laboratory standards of accuracy.

LIBERAL INGOT DISCARD Large discards, from both the top and bottom of the ingot, mean that the buyer gets only the "cream" of the tool steel.

HAMMER-COGGING OF INGOTS It's far costlier to hammer-cog ingots than to roll them. But the tremendous impact developed under the 14,000-lb. hammer insures a complete working of the entire ingot and the breaking up of all undesirable ingot structure.

PROGRAM-CONTROLLED ANNEALING The exact heating, soaking and cooling curve desired is obtained by a motor-driven cylinder on which the edge of a plate guides the temperature regulator. Possibilities of human error are eliminated.

RIGOROUS INSPECTION Thoroughly representative cross-sections for inspection are obtained by cutting slabs from the tool-steel billet stock before rolling, and cutting discs from the finished bars. . . . These samples are subjected to hot-acid etch, hardenability tests and microscopic examination.

BETHLEHEM SPECIAL HIGH-SPEED TOOL STEEL

—for the usual high-speed steel applications.

BETHLEHEM EXTRA-SPECIAL HIGH-SPEED TOOL STEEL

—a tool steel for exceptionally severe service.

BETHLEHEM FINISHING TOOL STEEL

—a tungsten alloy water-hardening tool steel.

BETHLEHEM XXX SPECIAL TOOL STEEL

—a carbon finishing tool steel of the highest grade.

BETHLEHEM SUPERIOR TOOL STEEL

—a carbon-vanadium tool steel possessing the characteristics of straight-carbon tool steel combined with superior physical properties.

BETHLEHEM XX TOOL STEEL

—a general-purpose tool steel of extra-fine quality.

BETHLEHEM XCL TOOL STEEL

—for all purposes requiring a uniform and reliable yet comparatively inexpensive grade of tool steel.

BETHLEHEM X TOOL STEEL

—an inexpensive grade of carbon tool steel which many users have found very satisfactory for a wide variety of uses.

BETHLEHEM TOOL ROOM OIL-HARDENING TOOL STEEL

—for intricate dies and master tools which must hold dimensions through heat treatment.

BETHLEHEM No. 71 ALLOY STEEL

—for chisels, shear blades and heavily-stressed machinery parts.

BETHLEHEM TOUGH TOOL STEEL

—a chrome-vanadium steel possessing a high degree of hardness and toughness.

BETHLEHEM LEHIGH DIE AND TOOL STEEL

—a high-carbon, high-chromium steel especially suited for long-run dies.

BETHLEHEM OMEGA TOOL STEEL

—an exceptional impact-resisting steel.

BETHLEHEM No. 57 HOT-WORK TOOL STEEL

—a chrome-tungsten steel for hot-work tools.

BETHLEHEM No. 445 HOT-WORK TOOL STEEL

—a chrome steel for hot-work tools.

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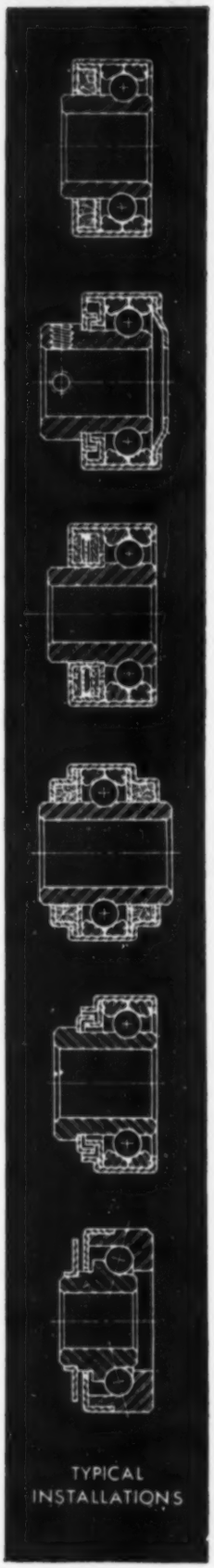
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM, PA.

LESS COST-HIGHER EFFICIENCY-SPEEDS UP TO 2500 R·P·M-EVERY SIZE
ALL TYPES OF INSTALLATION-MADE TO YOUR OWN SPECIFICATIONS



"COMMERCIAL" BALL BEARINGS meet the constantly increasing demand for good bearings at a moderate price. "COMMERCIALS" are obtainable in all standard sizes—large or small quantities.

Also, special installations, made to your own specifications. These bearings are used in all industries and for all purposes. They reduce bearing costs and give better service.

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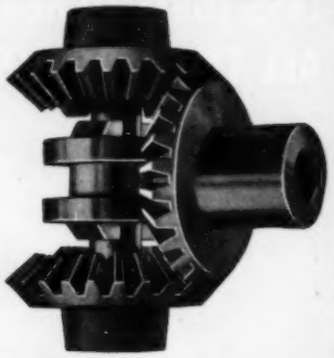
"Commercial"
ANNULAR BALL BEARINGS

The efficiency of your machines depends upon the efficiency of the gears. Grant gears cost no more than ordinary gears.

GRANT GEAR WORKS, BOSTON
ESTABLISHED 1877

Check our figures against your own production costs!



If you manufacture a product in which high-grade worms or gears are a necessary part you can probably save money by letting us act as your gear department.

Our modern factory contains more than 70,000 ft. of floor space equipped with the most efficient machinery; much of it specially designed and not found elsewhere.

Long experience, large volume, and correspondingly low overhead, enable us to furnish worms and gears of the highest possible quality at mass production prices.

Get our figures for furnishing part or all of your gear requirements, and compare them with your own production costs. You'll find an opportunity for new margins of profit.

Write for illustrated folder on Perkins custom cut gears.

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130 CIRCUIT AVE., SPRINGFIELD, MASS.

BILGRAM GEARS

Finest Cut Gears
For Over 50 Years

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Worms and Worm Gears
All Type Gears

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THE HARTFORD SPECIAL MACHINERY CO. Hartford, Conn.

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Cut Spur, Bevel and Worm Gears

All sizes. Every description. Operating Machinery for Bridges, etc. "Les Simplex" Cold Metal Saws

GEARS

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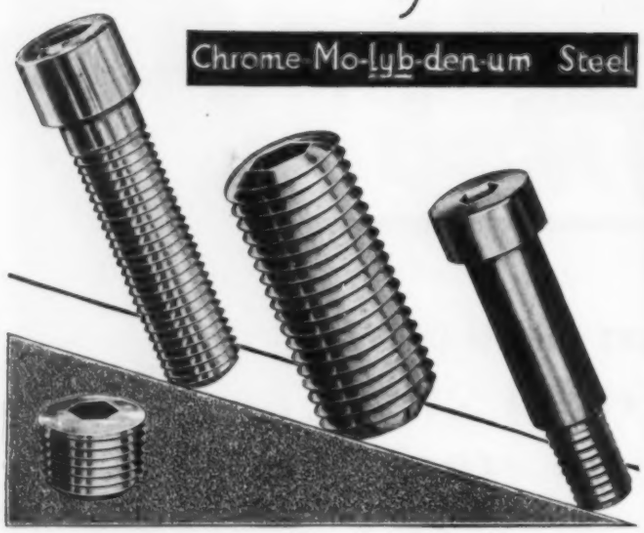
HEAT-TREATED

HOLLOW SCREWS

of

Chrome-Mo-lyb-den-um Steel



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By driving machinery direct from the lineshafting through Johnson Friction Clutches (one for every machine) you eliminate countershafts and overhead cross-belting—cutting the cost of equipment in half and getting a lighter, neater, cleaner machine shop. Any machine can be started or stopped at will. You can cut out non-producing machines while the others are running, thereby saving power.

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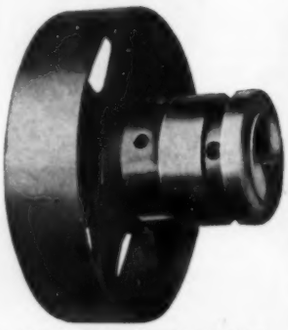

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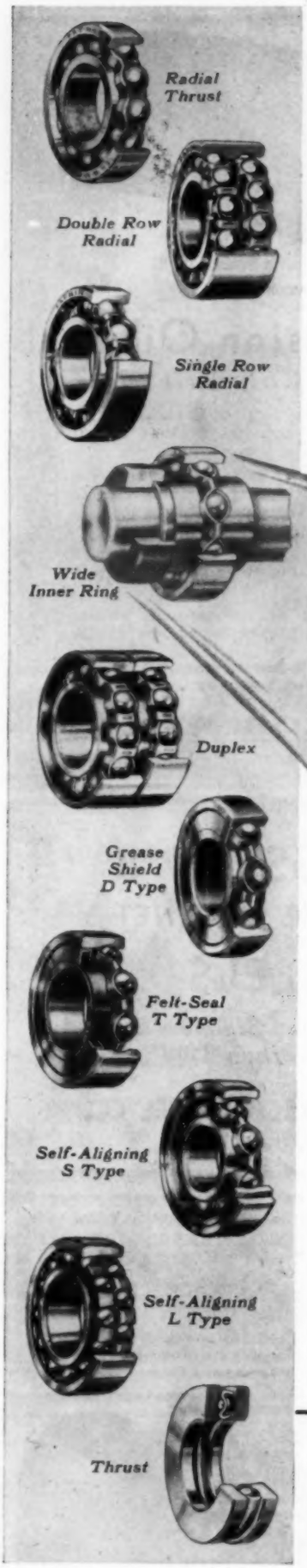

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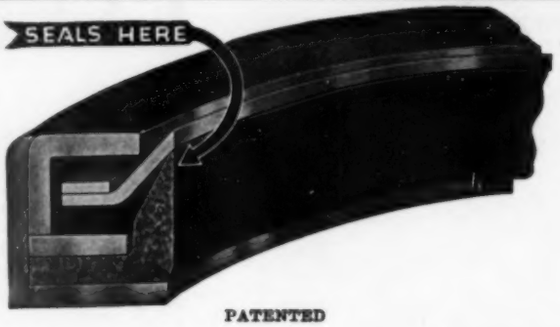

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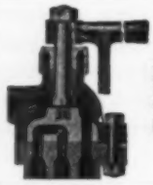

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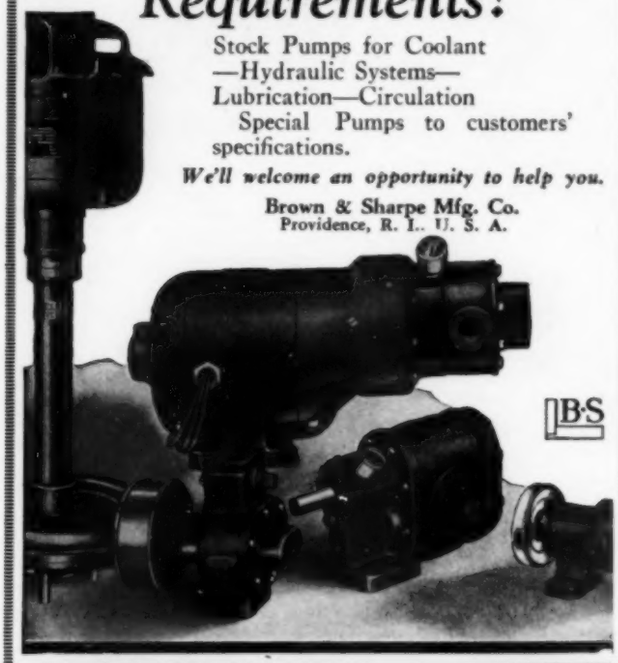

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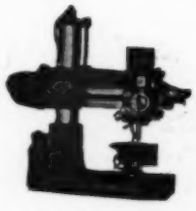

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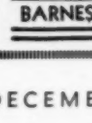

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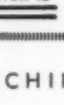

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Lathe shown is No. 92-C, 16″ swing by 6′ bed.

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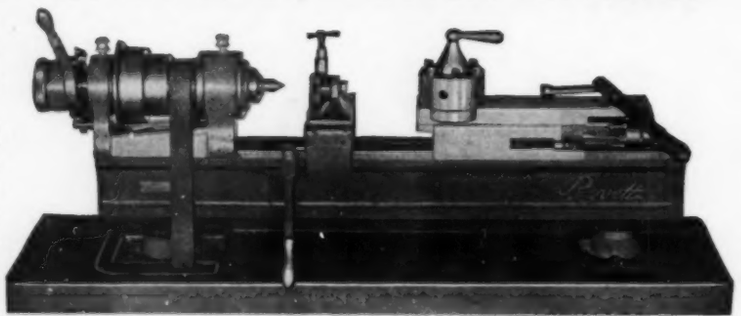

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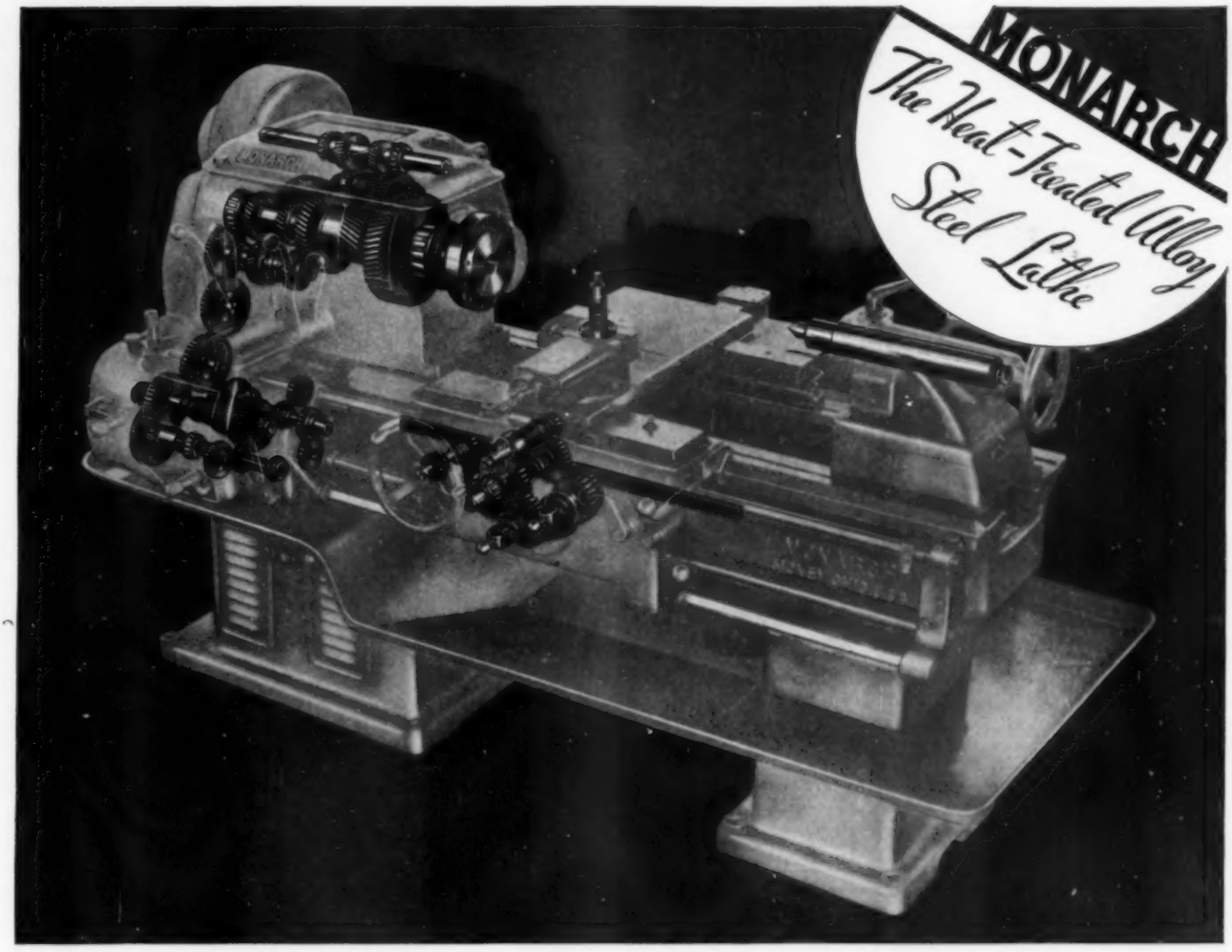

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IF your lathe equipment is not up to the Monarch standard . . . the modern standard . . . you are paying for Monarchs, without securing the benefits of their operation. Any lathe that will not produce the quantity, the quality, and the variety of work, at the low man-hour cost, that Monarch offers you . . . cannot make as much money for you.

Monarch lathes have more new features and many more positive advantages. A point for point comparison will emphasize these facts. And what are some of the features that account for Monarch lathes often heading the replacement list? Advantages like these: Helical gears, anti-friction bearings and many heat-treated steel parts (that result in their being known as "All Heat Treated Steel" Lathes). In addition, the high operating efficiency engineered into their design, insures maximum production, long-lived accuracy as well as more dependable and economical service.

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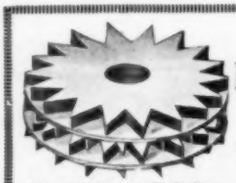

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No. 0 Desmond Cutters

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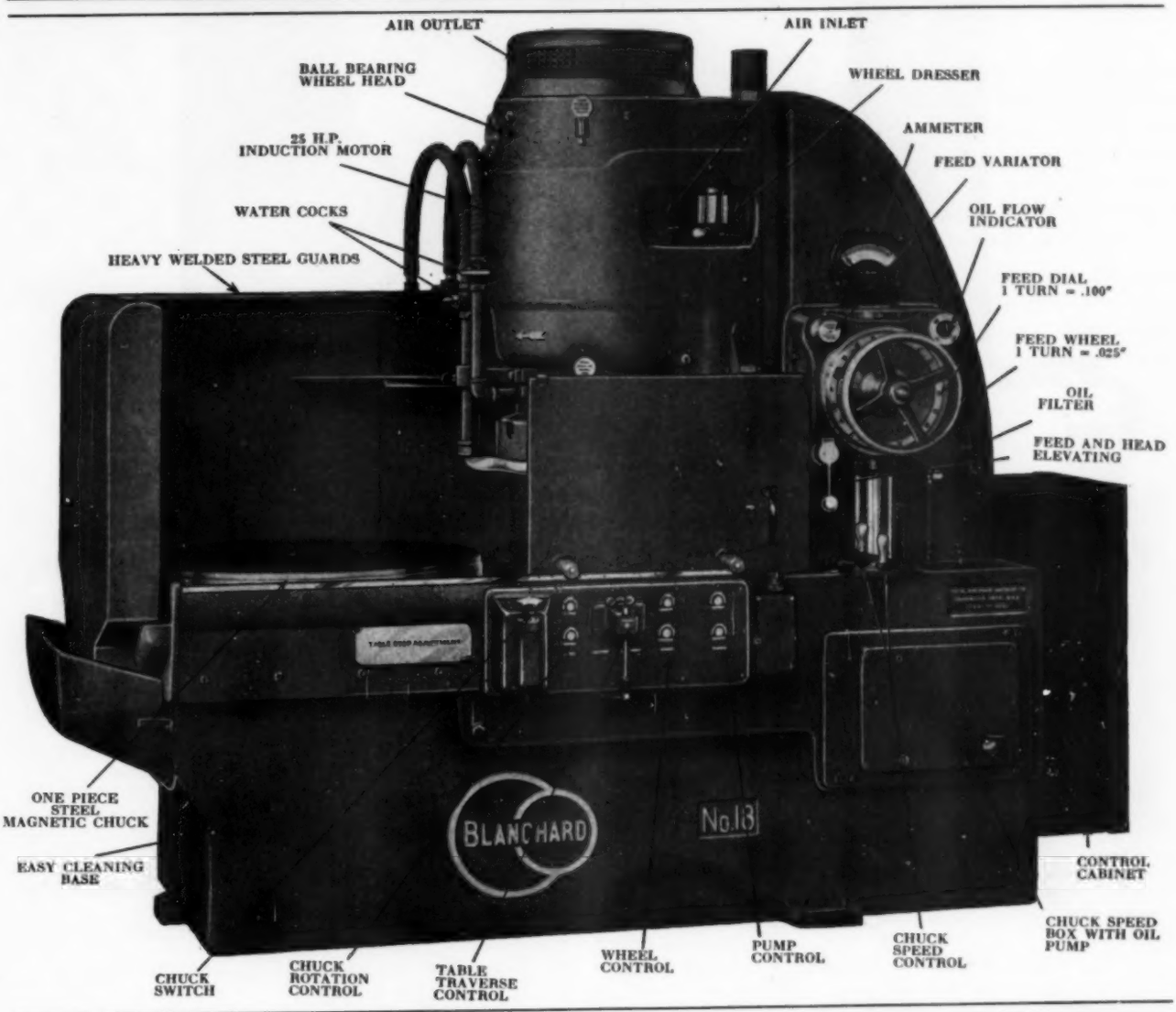

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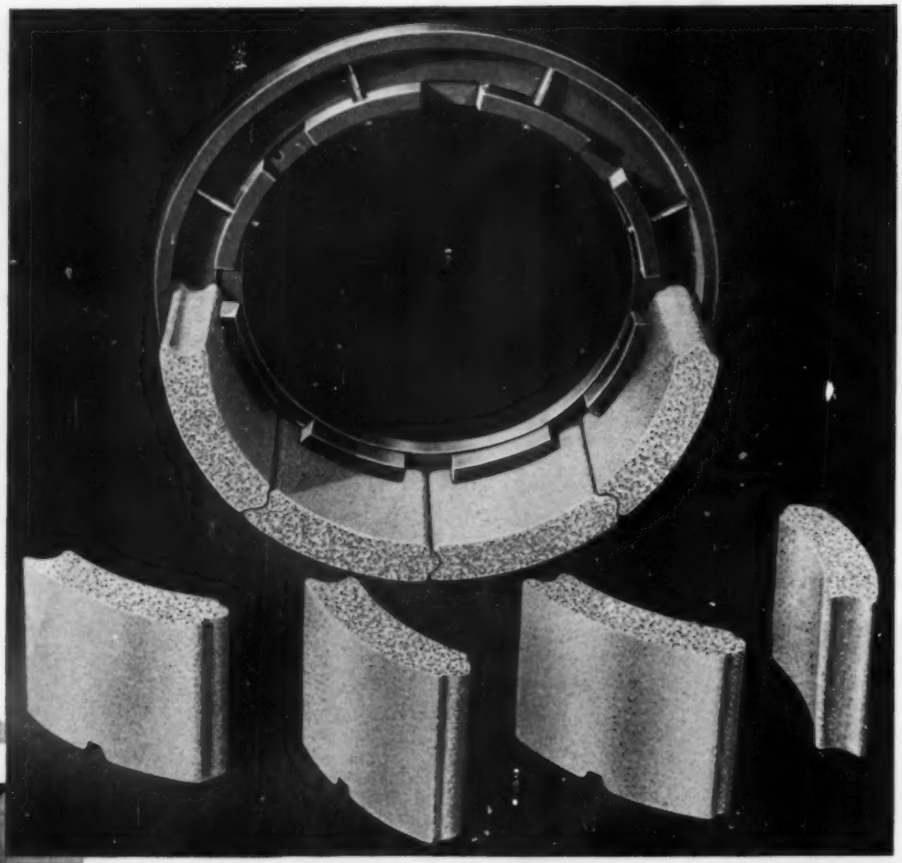

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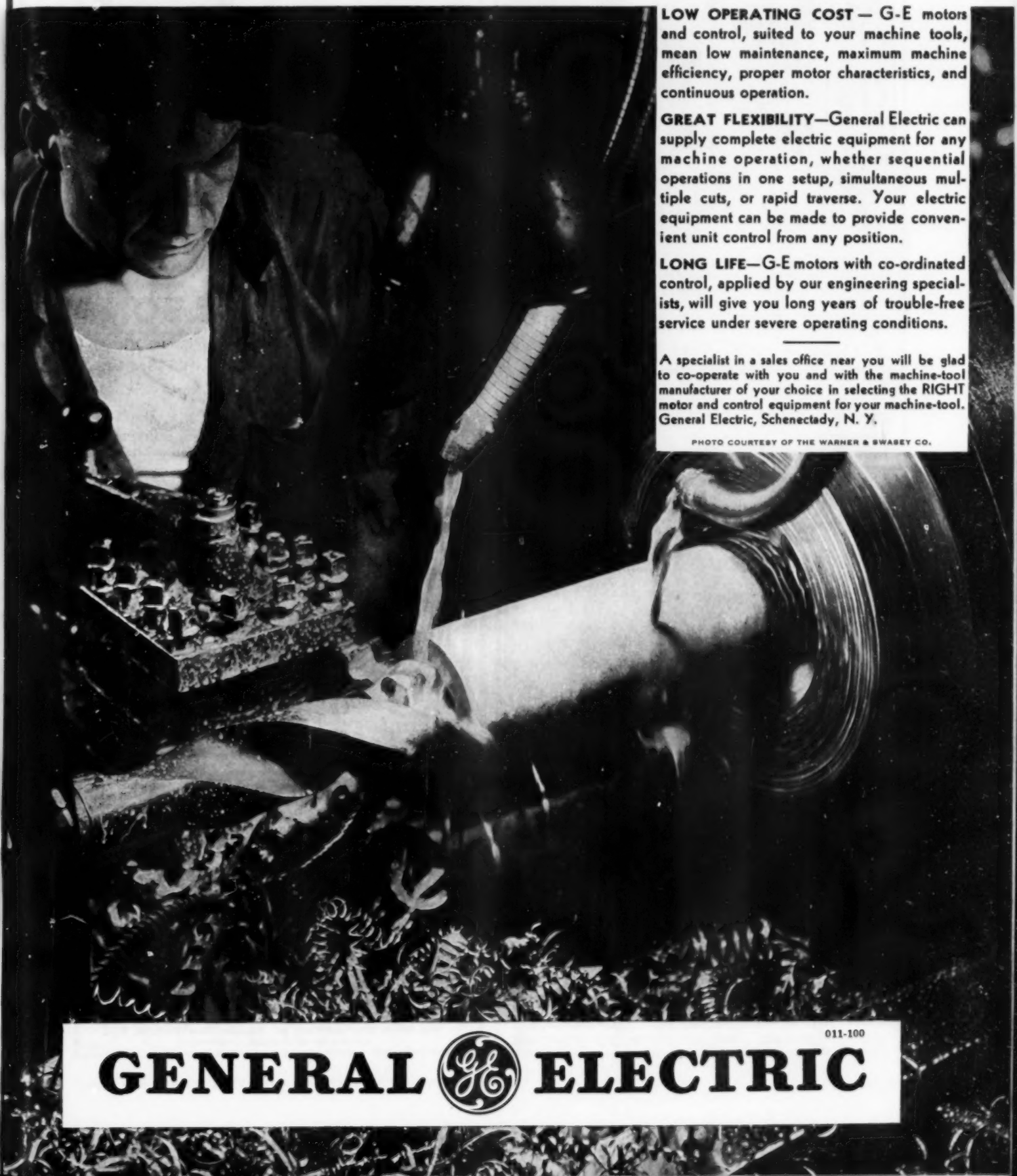

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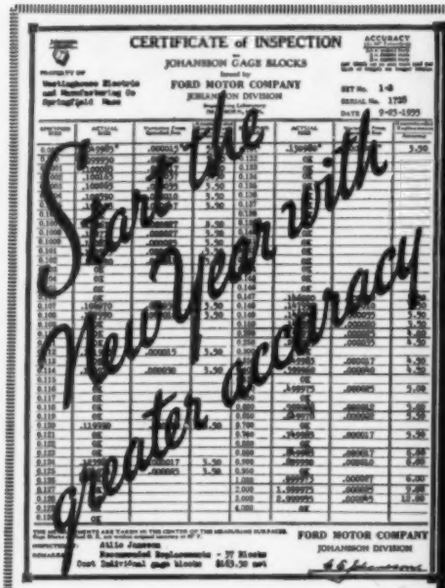

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New 1/10,000" Indicator
Model C-10

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Diameter of case	1¼"
Diameter over all	2"
Depth of case	¾"
Length over all	3½"
Lug or Bracket—Offset, on center if desired	Hole A"
Back held in position by	4 large screws
Center of spindle to center of hole in lug	¼"
Weight	8 ounces
Stem	⅛" diam.
Dial	0–5–0 or 0–10
Graduated	.0001"
Crystal	Non-breakable

Model C-10

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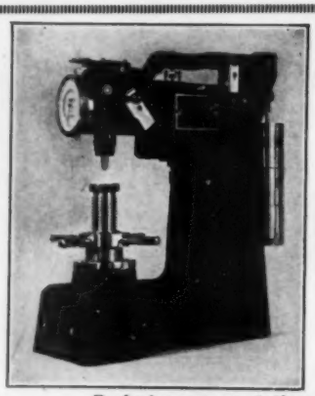
Makers of Gauges Since 1885



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HARDNESS TESTER

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THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

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NEW one—
MODEL 110
FEDERAL
COMPARATOR

Accurate—Measures .00005"

Even .000025" can be easily determined.
Send for Bulletin 110

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Ames Gauges
are durable, accurate, simply constructed. Made in a variety of styles and sizes.
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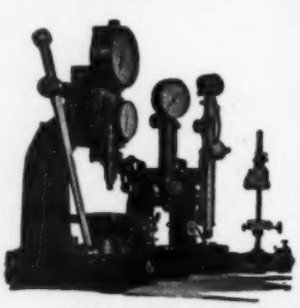
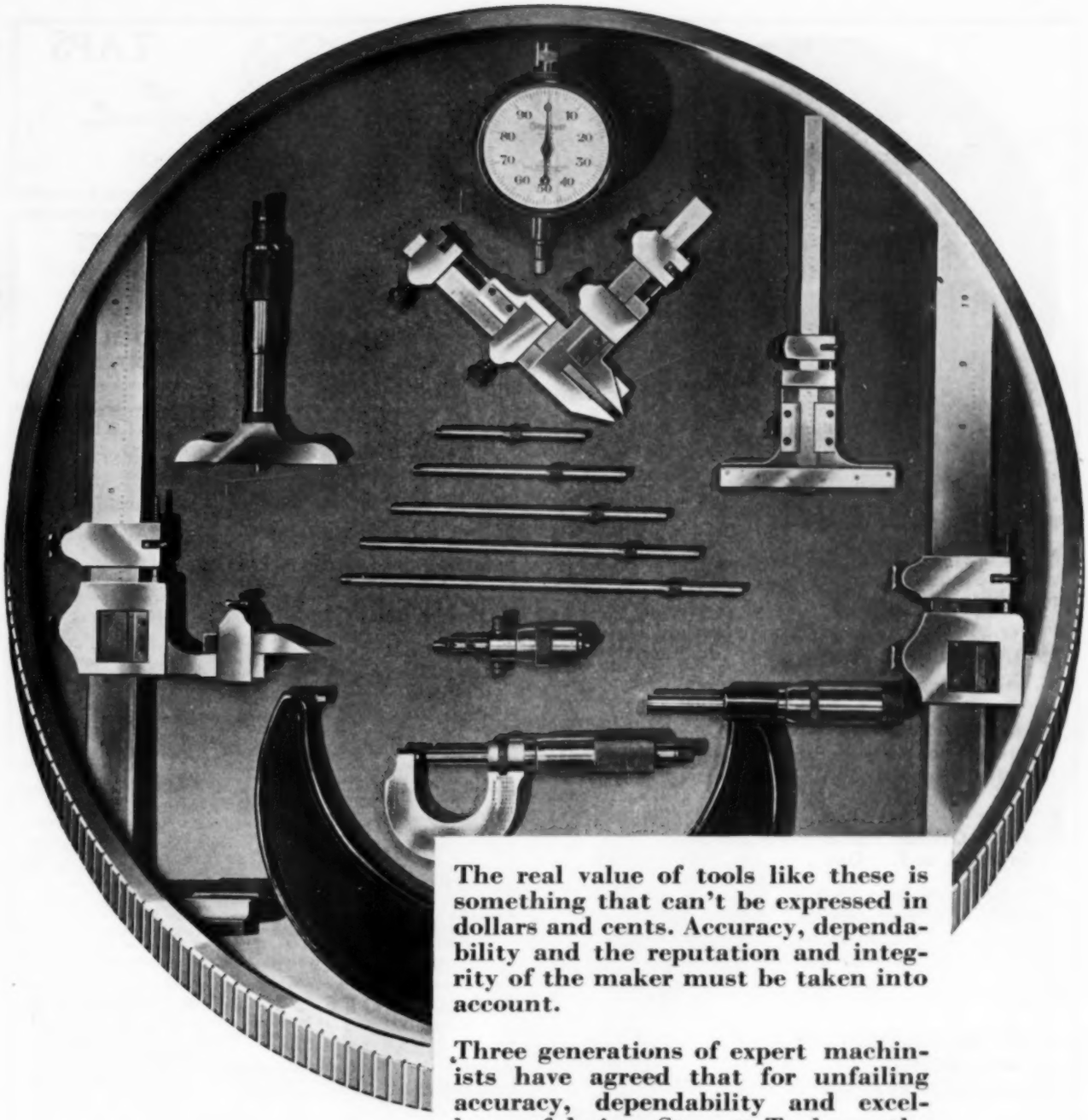
267

HARDNESS TESTING Should Be Made With Up-to-date Equipment—You cannot afford to experiment.



The **STANDARD SCLEROSCOPE** (Now highly Improved) for more than twenty years has made good and is still used for doing the world's hard work in testing. In general use for specifications purposes. Simple, Sturdy, Comparatively Inexpensive. Illustrated bulletins free. **FOR QUALITATIVE AND QUANTITATIVE HARDNESS MEASUREMENT,** under Static Pressure, the **MONOTRON** is the only machine now available. Operative up to over 2000 Diamond Brinell. Avoids errors due to spring in test pieces. Takes readings with the load on, avoiding reversal lash errors. No setting to zero. Operates at highest Speed. Has solved many old laboratory and shop problems. *We also make the Durometer for testing the hardness of rubber.* Comprehensive bulletins free.

THE SHORE INSTRUMENT & MFG. CO.
Van Wyck Ave. and Carll St., Jamaica, New York, N. Y.
Agents in all Foreign Countries



The real value of tools like these is something that can't be expressed in dollars and cents. Accuracy, dependability and the reputation and integrity of the maker must be taken into account.

Three generations of expert machinists have agreed that for unfailing accuracy, dependability and excellence of design, Starrett Tools are the finest that money can buy. Standardize on Starretts when you buy shop equipment tools.

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THE L. S. STARRETT CO.
World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
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USE STARRETT TOOLS

8497

A CLEAN BLOW
WITHOUT INJURY
TO SURFACE STRUCK

USE THE
BASA
HAMMER
WITH REMOVABLE FACES

Many operations in manufacturing and assembly work require a hammer-blow without marring the material struck.

Faster and more satisfactory work made possible with the

BASA HAMMER
MADE IN FIVE SIZES

Rawhide, Copper and Babbitt faces can be inserted in Head by simply loosening nut.

Faces Cannot Rattle in Head, or Fall Out

The clamping jaws of the "BASA" Hammer can be set up to take care of shrinkage or wear of the Faces.

TAKE NO CHANCES OF DAMAGING FINISHED SURFACES

ALL FACES MADE IN U. S. A.

Send for full particulars.

GREENE, TWEED & CO.
SOLE MANUFACTURERS
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DIES **TAPS**
Right from the Lead
THE GEOMETRIC TOOL CO.
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DIEHEADS SELF OPENING
TAPS COLLAPSIBLE
THREAD SPECIALISTS
THE MURCHEY MACHINE & TOOL CO.
951 PORTER ST. DETROIT, MICH.

17 STYLES AND SIZES
MERRELL
PIPE THREADING For BETTER threads MACHINES
TOLEDO, OHIO

Famous for quality of threads they produce, long life of chasers and all-around dependability.
Following literature available:
Bulletin on H & G General Purpose Die Heads,
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See our advertisement on page 265 of September 11th American Machinist.
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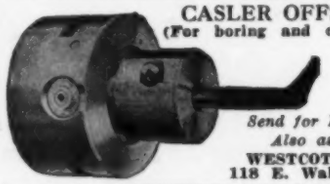
CASLER OFFSET BORING HEADS
(For boring and counterboring holes to size.)



Reduce cost of jigs, fixtures and experimental work and save time and money in straight manufacturing.
Send for Free Catalog. No obligation.
Also ask for our Chuck Catalog.
WESTCOTT CHUCK COMPANY
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CRALEY OFF-SET BORING HEAD

Micrometer adjustments, hardened and ground wearing parts—precision that warrants UNCONDITIONAL MONEY BACK GUARANTEE. 5 sizes—to 16" holes; sold direct, complete with 5 boring tools in velvet lined metal box. Send for details, prices. C. C. Craley Mfg. Co., Shillington, Pa.

Barnes Hack Saw Blades
Red Arrow—High Speed Steel Hack Saws.
Special Unbreakable Hack Saws.
Tungsten Hand and Power Hack Saws.
and Metal Cutting Band Saw Blades.
W. O. BARNES CO., 1301 Terminal Ave., DETROIT, MICH.
And Leading Jobbers Everywhere

NO BROKEN TOOL BITS

No. X 1-2-3-4-5

because a file hard tool steel support.
THE READY TOOL COMPANY
Iranistan & R.R. Aves., Bridgeport, Conn.

Another Winner IN THE PRODUCTION SWEEPSTAKES—

The "Maxi" Drill—the drill with the jet black finish—is setting new production records daily

The "Maxi" Drill is black, but it's no "dark horse." It's already proved itself on hundreds of jobs. Its amazing performance is due to highest grade high speed steel, polished flutes for easy chip passage, and a *special type of surface treatment which gives far longer than average wear.* "Maxi" Drills are colored black to identify them beyond the possibility of error. They cost no more than any high speed steel drill. Look for the drill with the jet black finish.

"Maxi" Drills are available in any size and type of twist drill which is ordinarily manufactured in high speed steel, at no extra cost.

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GREENFIELD TAP AND DIE CORPORATION
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CARD TAPPER TAPS

Use them once—test their value on the basis of cost per tapped hole—and these taps will do their own selling. Bent Shank and Straight Shank Tapper Taps in machine screw or fractional sizes for all types of machines. Give your fast automatic machines every chance to maintain high production—use CARD Taps.

Sold by leading dealers everywhere. Write for the name of the dealer nearest you.

S. W. CARD MFG. CO.
DIVISION OF UNION TWIST DRILL CO.
MANSFIELD, MASSACHUSETTS, U.S.A.

TWIST DRILLS—MILLING CUTTERS—TAPS—DIES—REAMERS
DRILL CHUCKS—WHEEL DRESSERS—SPECIAL TOOLS

FACTORY:
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THE STANDARD TOOL CO.

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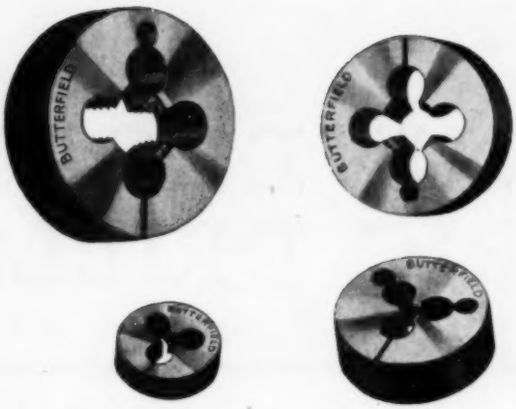


Modern Valves
must have
GOOD THREADS

Improved designs and the liberal use of corrosion-resisting alloys have played an important part in the development of modern valves—which stand up for many years under the high temperatures and pressures of present-day power plant practice.

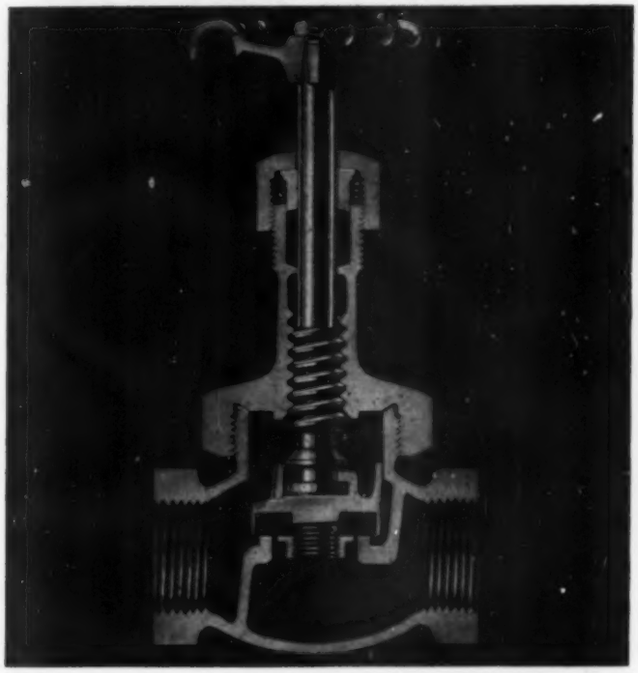
Scarcely less important, however, is the improvement in the quality of their threaded connections—upon which the efficiency of most valves is entirely dependent.

The fact that so many leading manufacturers of valves and fittings rely largely on Butterfield Taps, Dies and Reamers constitutes another significant indication of their superior efficiency and economy.

UNION TWIST DRILL CO.,
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.

STORES: New York, 62 Reade St. Chicago, 11 So. Clinton St. Cleveland, Hal. W. Reynolds, 3346 Superior Ave. Detroit, 1050 Mt. Elliott Ave. Toronto, 49 Main St., Mimico. Montreal, 111 St. Paul St., West. Agents for Great Britain—Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S. E. 11, England. Branches at Birmingham, Manchester, Glasgow, Newcastle-on-Tyne and Bristol.

Jenkins, Fig. 106-A, Sectional View



New Profit Margins

—are constantly being discovered by progressive manufacturers of metal products through the use of *Butterfield "Commercial Ground" High Speed Steel Taps.*

Made of 18% Tungsten Steel, with all cutting surfaces ground to a high polish, these modern taps give unbelievably long runs and produce "Class 2 Fit" Tolerances until entirely worn out.

Butterfield High Speed Steel Taps are available also in two other grades: *"Cut Thread"* for tough stringy materials, and *"Precision Ground"* for use where extreme accuracy is required. Catalog promptly on request.

BUTTERFIELD
HIGH SPEED STEEL TAPS

New CP UNIVERSAL ELECTRIC DRILLS

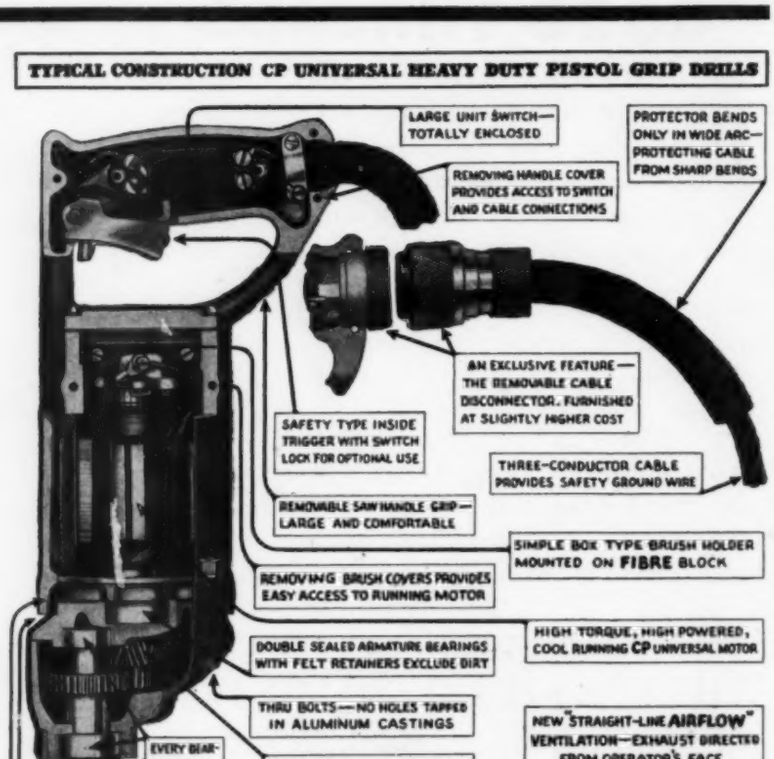
Designed and Built FOR THE TOUGHEST PRODUCTION WORK

The types of CP Universal Electric Drills shown above are but representative of the complete line now available for metal and wood drilling from 3/16" to 1" capacities.

These new drills are real production tools . . . definitely designed and built to withstand hard, heavy duty, continuous application . . . and to deliver more and better work at a lower maintenance cost than ever before possible.

The adjoining sectional view of a Pistol Grip Type of CP Universal Drill shows general features of design and construction which are typical of the entire line. Complete details are available in a special bulletin—No. 899—just published. Send for your copy . . . now.

TYPICAL CONSTRUCTION CP UNIVERSAL HEAVY DUTY PISTOL GRIP DRILLS


LARGE UNIT SWITCH—TOTALLY ENCLOSED
PROTECTOR BENDS ONLY IN WIDE ARC—PROTECTING CABLE FROM SHARP BENDS
REMOVING HANDLE COVER PROVIDES ACCESS TO SWITCH AND CABLE CONNECTIONS
AN EXCLUSIVE FEATURE—THE REMOVABLE CABLE DISCONNECTOR. FURNISHED AT SLIGHTLY HIGHER COST
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REMOVABLE SAW HANDLE GRIP—LARGE AND COMFORTABLE
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HIGH TORQUE, HIGH POWERED, COOL RUNNING CP UNIVERSAL MOTOR
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THRU BOLTS—NO HOLES TAPPED IN ALUMINUM CASTINGS
NEW "STRAIGHT-LINE AIRFLOW" VENTILATION—EXHAUST DIRECTED FROM OPERATOR'S FACE
EVERY BEARING A BALL BEARING—MOUNTED IN STEEL INSERTS CAST INTEGRAL
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STEEL BEARING CAP PROTECTS ALUMINUM GEAR CASE
FLARED HOUSING—NOT WEAKENED BY DRILLED VENT HOLES

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SALES AND SERVICE BRANCHES ALL OVER THE WORLD

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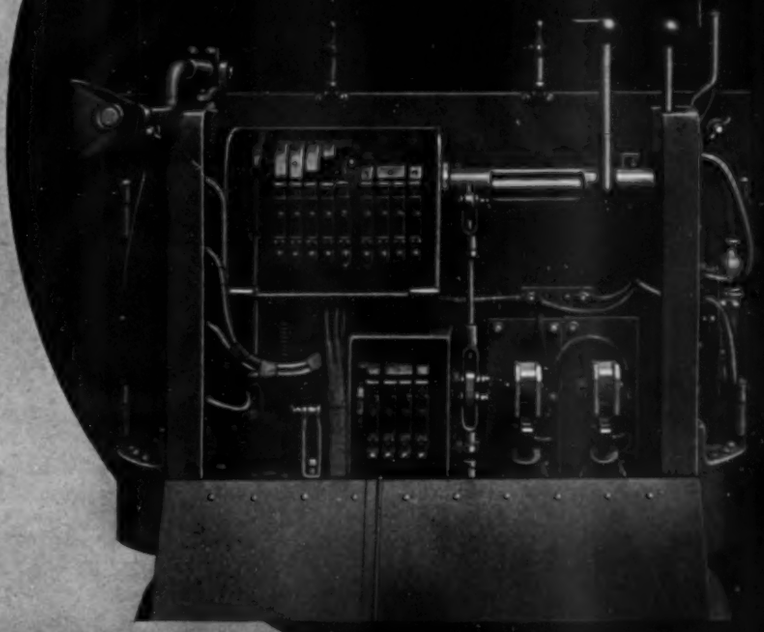
DIAMOND CORE DRILLS • DIESEL ENGINES • ELECTRIC TOOLS
PNEUMATIC TOOLS • VACUUM PUMPS & CONDENSERS
OIL WELL ROCK BITS, REAMERS & TOOL JOINTS

New SAFETY AND ECONOMY are secured



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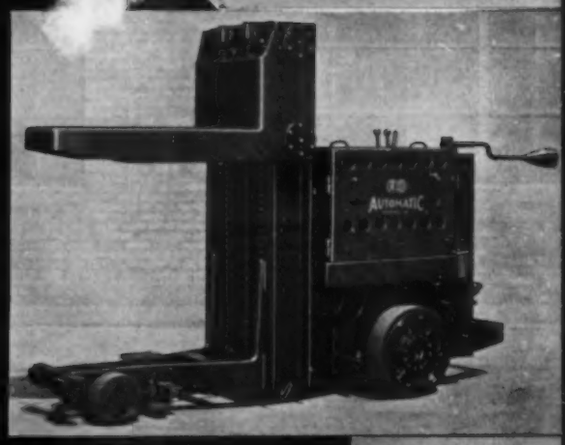
The low cost way to tier materials, handle dies, or for general transportation. Available in capacities to 50 tons.



by the New "AUTOMATIC" Centralized CONTROL SYSTEM...

LOW LIFT TRUCKS

Quick, safe, and economical material handling of unit loads on skids. Available in capacities to 50 tons.

A MODERN Transportation Need is a Need for a Modern "AUTOMATIC" Write for Details

Safe and economical truck operation depends largely on the design and proper functioning of the controller.

"AUTOMATIC" designed and built centralized control systems, embody many unique and exclusive features. The speed and hoist controls are group mounted as an integral unit. This assures easy accessibility for inspection and maintenance.

The controller is of the full interlocking type. Application of the brake returns the speed drum to neutral. Direction of travel cannot be reversed until the brake is released, eliminating plugging of the motor. When the operator leaves his driving position, all controls are automatically locked in neutral, preventing unauthorized operation.

Low maintenance and high operating efficiency are secured by breaking the battery arc on magnetic contactors. New, one-piece, cast-bronze segments prevent misalignment and result in high conductivity.

AUTOMATIC TRANSPORTATION COMPANY
DIVISION OF YALE & TOWNE MANUFACTURING CO.
59 WEST 87th STREET CHICAGO, ILLINOIS

Elevating Platform Trucks.
High Lift Trucks.
Telescopic Trucks.
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Locomotive Crane Trucks.
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Special Crane Trucks.
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AVAILABLE IN CAPACITIES UP TO 50 TONS

TRADE **AUTOMATIC** MARK

Electric and Gas-Electric MATERIAL HANDLING EQUIPMENT

• THE REASON FOR LOW COST TRANSPORTATION •

It Takes

TO GIVE YOU THE RIGHT

WE HAVE THAT EXPERIENCE

IN G-E welding equipment and electrodes lies more than mere nicety of design, for, in addition, they are built on the solid foundation of years of experience with electric welding—experience which only the most extensive user of electric welding can have; experience involving years of engineering research and development, followed by actual use.

From small pipe lines to large turbines—this is the scope of application of electric welding in G-E factories. Here, electric welding is applied more extensively and to a greater variety of products than in any other manufacturing plants in the world.

The fundamentals of all welding problems are very much alike—your requirements and ours are essentially the same. To help you produce stronger, lighter, and more compact products—products that provide added dividends in higher quality and lower cost—G-E experience is at your command, through improved welding equipment and electrodes and through engineering advice.

In addition, we offer you prompt and efficient service through our welding distributors—there is one near you.

One great advantage of using W-20 for arc-welding tubes to the tube sheets of G-E tubular transformers is that this rod may be bent without damaging the specially woven heavy flux coating, in order to reach into confined spaces

THE MORE WE WELD — THE BETTER WE SERVE

Experience

WELDING EQUIPMENT AND ELECTRODES

OUR engineers chose single-operator-type welders and Type W-20 electrode for joining oil-circulating tubes to the tube sheets of transformer tanks because:

1. Joints Must Be Oiltight and Moistureproof—The adequate arc stability of the G-E single-operator welder in combination with Type W-20 heavily coated electrode makes it easy for the operator to produce uniform, high-quality welds. W-20 gives the deep penetration and the dense weld metal necessary to produce oiltight, moistureproof joints.

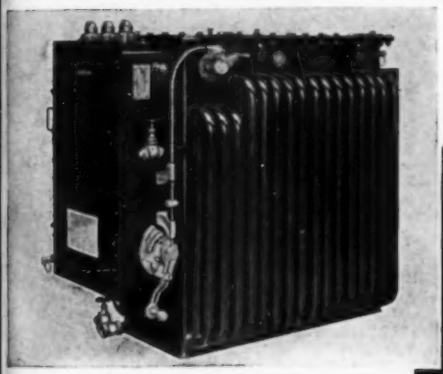
2. Welds Must Have High Corrosion Resistance in order to give the customer long, reliable service. The heavy flux coating of W-20 electrode helps to remove impurities from the molten weld metal, and during burning it produces gases which blanket the weld metal, excluding nitrogen and oxygen of the air from contact with it. The weld metal is thus very resistant to corrosion because of the absence of nitrides and oxides, which are subject to rapid corrosion.

3. Welds Must Be As Strong and Ductile As the Base Metal in order to prevent cracking due to uneven expansion of the tubes, tank shell, and weld metal because of changing temperature. The action of the heavy flux coating of W-20 in (1) removing impurities from the weld metal, (2) excluding active nitrogen and oxygen which might otherwise combine with and tend to embrittle the weld metal, and (3) annealing the metal during cooling, helps to produce a weld which has strength and ductility as good as those of the parent metal.

4. Welds Must Be Good-looking As Well As of High Quality because the appearance of a product means a great deal to the customer. The heavy fluxing of W-20 and the steady current supply of the G-E single-operator welder promote a smooth flow of molten metal to the joints. The ease of welding with W-20 helps the operator to produce good-looking, uniform welds.

5. Welds Must Be Made in Difficult Positions and Locations—Since W-20 can be bent to reach into confined spaces without damaging the specially woven flux coating, and since this rod will produce equally good welds in any position and location, welding is facilitated. The heavy flux coating acts as insulation, preventing short-circuiting of the rod on metal parts of the assembly.

6. Arc Welding Must Demonstrate Its Economy on This Job—W-20 has a high melting rate and deposits beads that are easy to clean. This makes possible faster welding speeds, which saves time and reduces the cost of welds. Since the deposition efficiency of W-20 is high (more inches of weld per inch of electrode are obtained) electrode costs are reduced. Also, arc welding gives a stronger, lighter, more compact assembly than is possible by any other method of fabrication.



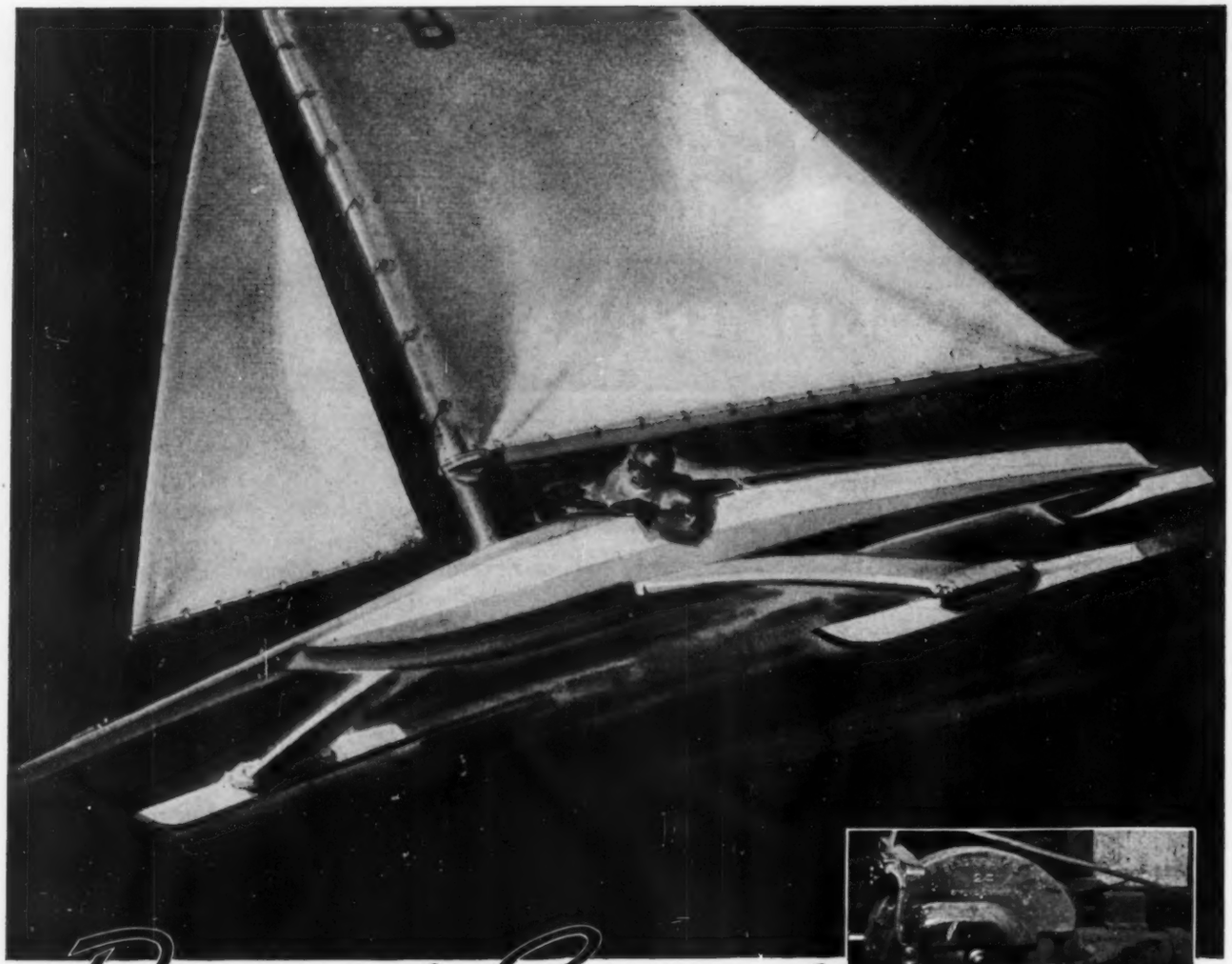
This subway network transformer was arc-welded with G-E single-operator-type welders and Type W-20 electrode

Arc-welding oil-circulating tubes to the tube sheets of a G-E tubular transformer

If you will inquire of the nearest G-E distributor or G-E sales office, they will be glad to give you information on the complete line of G-E equipment, electrodes, accessories, and cable. Also, at your request, they will be glad to send to your shop a trained specialist who can help you apply arc welding where it will improve the quality and reduce the manufacturing cost of your product. General Electric, Schenectady, N. Y.

140-32

GENERAL ELECTRIC



Record Speed

. . . ON ICE AND IN GRINDING

Reliable estimates place top speed in ice-boating at less than 7,480 f.p.m. Bakelite Bonded Snagging Wheels run 9,500 s.f.p.m.!

THE HIGHEST speed even estimated to have been attained by an ice boat is 84 miles per hour! Authorities state that the structural strength of such craft could not endure the wind pressures of speeds over 85 to 90 m. p. h.

In industrial abrasive wheels, also, maximum safe speed is limited by the strength of their construction. That is why the substantially stronger bonding material, Bakelite Resinoid, has set new speed records in grinding. Bakelite Bonded snagging wheels now operate safely and continuously at 9500 s. f. p. m.; cut-off wheels at 16,000 s. f. p. m.!

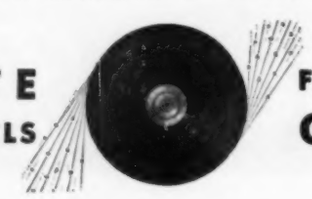
Other outstanding characteristics of Bakelite Bonded wheels that contribute to their superior performance are: cool-running porous structure; self-renewing cutting edges; freedom from softening or gumming of the bond; and longer production life.

Any leading abrasive wheel manufacturer★will be glad to advise you where Bakelite Bonded wheels might speed up your production or lower costs. Write us for copy of our booklet 14G, "High Speed Abrasive Wheels".

★*The trademark "REDMANOL" is also used to indicate abrasive products bonded with our resinoids.*

BAKELITE CORPORATION, 247 Park Ave., New York . . . 43 East Ohio St., Chicago
BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario, Canada

BAKELITE BONDED WHEELS



FOR HIGH SPEED GRINDING

Turn Weeks into Days *with* JIGS AND FIXTURES *"Shield-Arc"* WELDED

SAVE time in the drafting room. Eliminate pattern making. Cut grinding and finishing time. Follow these short cuts, made possible by the "*Shield-Arc*" welding of jigs and fixtures and you can take days, even weeks, off tooling-up time.

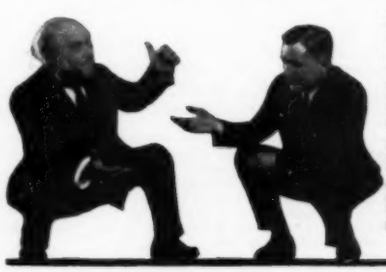
Hand-in-hand with the saving in time by "*Shield-Arc*" welding this equipment, you naturally realize an enormous saving in costs. Plants report reduction in costs as high as 60%!

Drawings are simplified. Less materials, usually standard stock items, are used. Fewer manufacturing operations are required; all steps can be performed side-by-side, under the supervision of one man.

No matter what type or size of jig and fixture you want —whether it is welded from two pieces or 20—"*Shield-Arc*" welding is the quickest and the cheapest way. And the product is better—lighter, stronger and more rigid!

When you turn to "*Shield-Arc*" welding, you line up with Lincoln... Arc Welding Headquarters... a service organization whose business it is to keep you a step ahead in securing all the savings arc welding offers. Call in the Lincoln man now. There is no obligation. Address THE LINCOLN ELECTRIC COMPANY, Dept. A-198, CLEVELAND, OHIO. Largest Manufacturers of Arc Welding Equipment in the World.

POP: "Speaking of jigs, I could dance one every time I think how we've turned tooling-up weeks into days."



LAD: "Why stop there? Think how *'Shield-Arc'* hard-surfacing has cut our tooling costs in half, how *'Shield-Arc'* fabrication has made our plant and product structures lighter, stronger and less costly. Man, *'Shield-Arc'* has turned steel into cash, the world over."

Mail this Coupon TODAY

THE LINCOLN ELECTRIC CO., Dept. A-198, Cleveland, Ohio

Gentlemen: Please send me more data about *"Shield-Arc"* savings. We now use (check which) electric arc ☐ gas ☐ none ☐.

Firm.....

Your Name..... Title.....

Address.....

City..... State.....

YOUR CLEANING DONE BETTER!

A competent study of the metal surface to be cleaned, the dirt or other foreign matter to be removed, the temperature and strength of solution, water condition, the production schedule, preceding and succeeding operations, is the best assurance that your production cleaning will be done with the greatest economy, the greatest certainty of uniform results.

Oakite specialized cleaning knowledge, gained from 26 years' experience, enables Oakite Service Men to give due attention to every factor that influences cleaning. Discuss your cleaning operations with him today. His ideas are yours for the asking. No obligation.

OAKITE PRODUCTS, INC.
GENERAL OFFICES
24 THAMES ST. NEW YORK, N.Y.

Branch Offices and Representatives in All Principal Cities of the U.S.

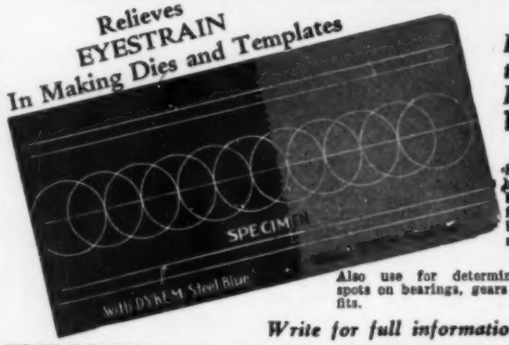
Since 1909 the STANDARD of Cleaning Quality

OAKITE

SPECIALIZED INDUSTRIAL CLEANING MATERIALS & METHODS

DYKEM STEEL BLUE

Relieves EYESTRAIN In Making Dies and Templates



Better than Blue Vitriol

Simply brush on; Ready for use in few minutes.

Also use for determining high spots on bearings, gears and other fits.

Write for full information.

THE DYKEM CO., 2301 No. 11th St., St. Louis, Mo.

ASK ANY TOOL-MAKER WHAT THIS MEANS,

He Will Shudder!

Write to

THE WALTON COMPANY
96 Allyn St., Hartford, Conn.

For production or job work—fast and accurate on a wide range of slotting, keyseating, splining and grooving. Work centers itself—requires no skilled operator. Write for catalog.

Giant KEYSEATERS

MITTS & MERRILL
913 Tilden St.
Saginaw, Michigan

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EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED—RATE PER WORD:

Positions Wanted (full or part time salaried employment only) 5 cents a word, minimum $1.00 an insertion, payable in advance.

See ¶ on Box Numbers.

Positions Vacant and all other classifications, excepting Equipment, 10 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads. Replies forwarded without extra charge.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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GENERAL SUPERINTENDENT wanted for machine shop, structural plate shop, foundry and pattern shop, normally employing 150 men doing contract and jobbing work. Address E. L. Pearce, President Lake Shore Engine Works, Marquette, Mich.

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GEAR ENGINEER, 9 years' experience designing all type gears for machinery, appliances, speed reducers. Familiar with all production and inspection methods. PW-927, American Machinist, 330 West 42d Street, New York City.

Minnesota

MACHINE SHOP FOREMAN, 5 years' experience, also expert machinist and experienced repair and maintenance man, age 30, desires change of position. Good references. PW-940, American Machinist, 520 No. Michigan Ave., Chicago, Ill.

POSITIONS WANTED

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EXECUTIVE-SALES. Am interested in connection with first class manufacturer, or agency; will consider reasonable investment; just sold out my business and patents; long technical experience machine-tools, specialty machinery, etc.; well educated, widely traveled here and abroad, 40, aggressive, enjoy hard work, no objection to travel. PW-937, American Machinist, 330 West 42d Street, New York City.

EXPERIENCED sales engineer, college graduate with shop experience. Knows Mid-Eastern Seaboard territory. Capable executive, can assume responsibility for organizing and directing sales office for machine tool manufacturer. PW-938, American Machinist, 330 West 42d Street, New York City.

(Continued on opposite page)

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POSITIONS WANTED

(Continued from opposite page)

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72" King Vert.
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30"x12' Lodge & Shipley, sel. grd. hd.
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36"x18' Rahn-Larmon
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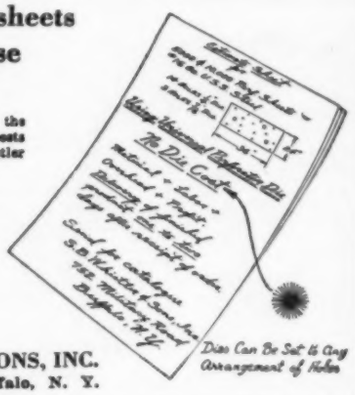

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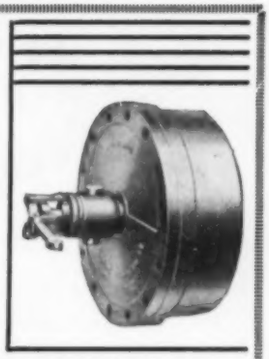

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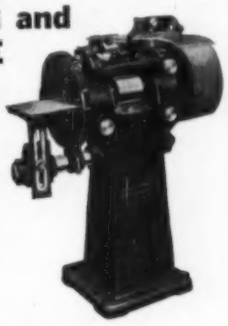

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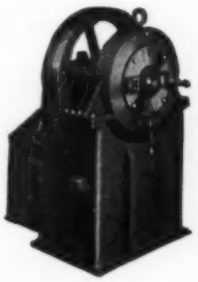

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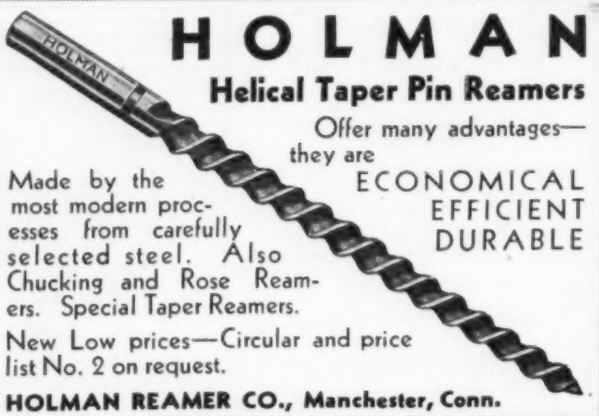

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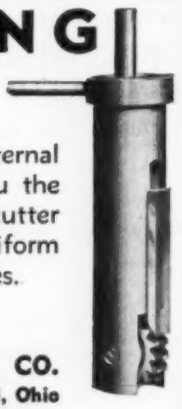

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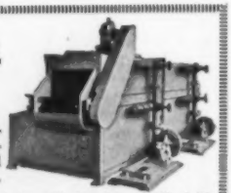

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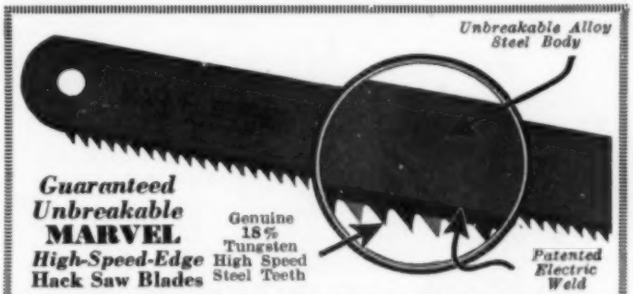

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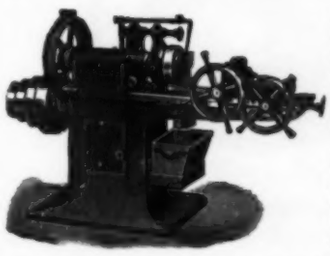

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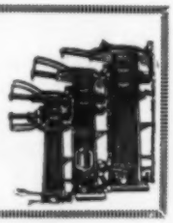

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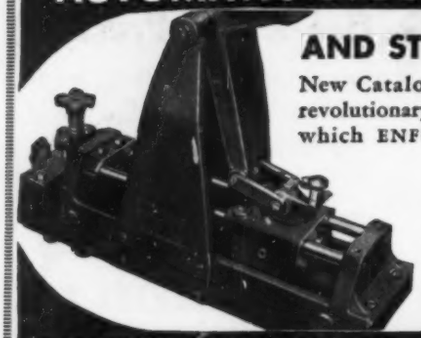

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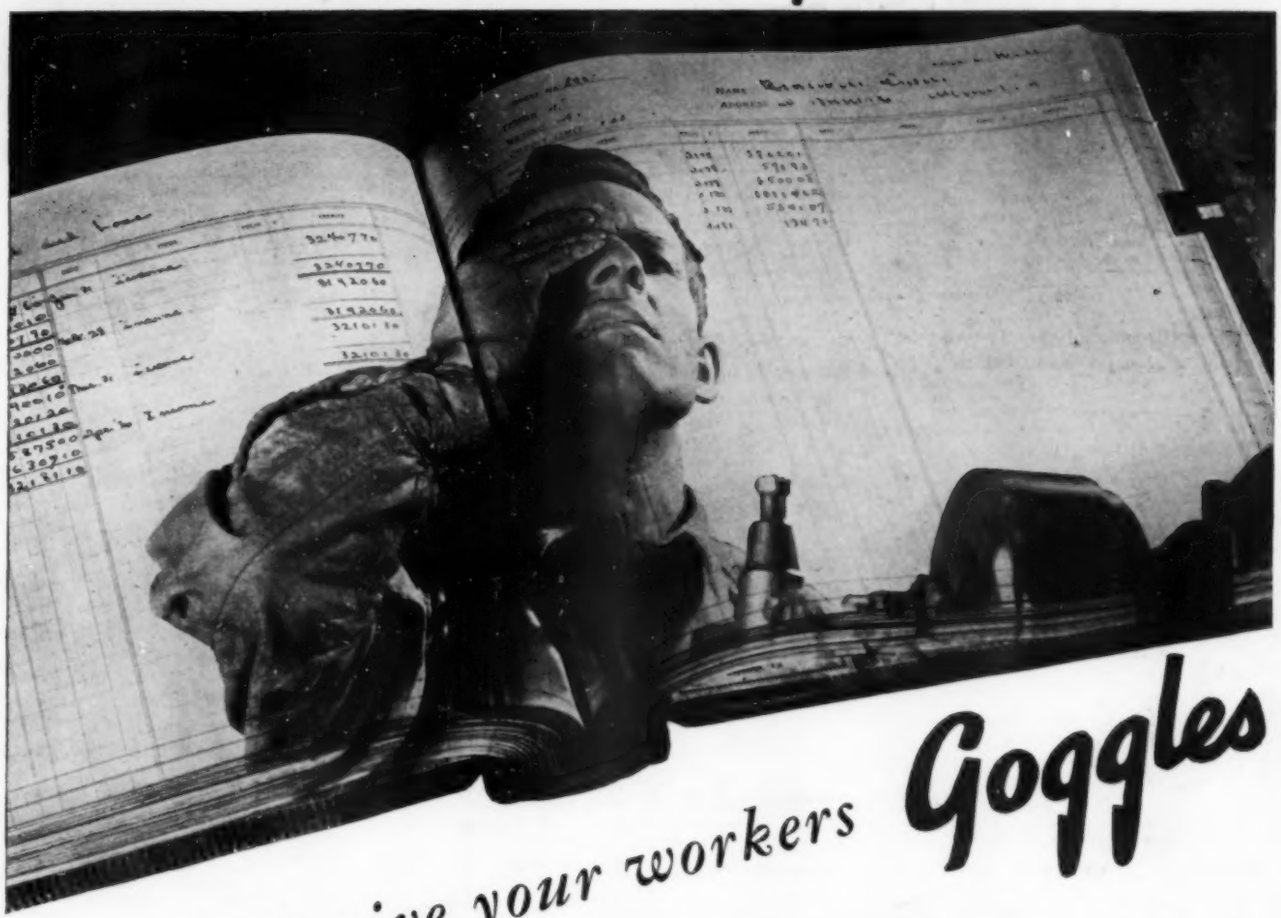

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